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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXVII NO. 7 | SAN FRANCISCO, AUGUST 12, 1911 | PER COPY, 25 CENTS

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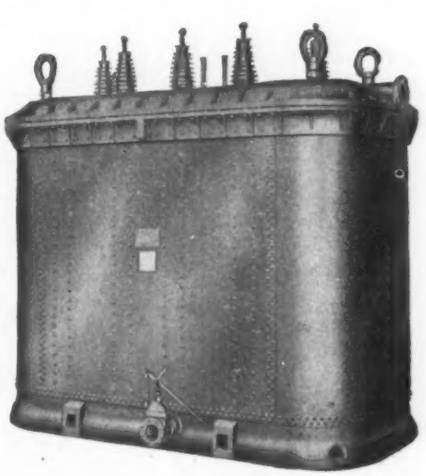

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Alphabetical Index to Advertisers, Page 8. Where to Buy It in the West, Pages 10, 11.

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POWER AND GAS
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UNITED RAILROADS' ABANDONMENT OF STEAM

On June 18, 1911, the United Railroads began operating its cable plant at Mason and Washington streets by electricity. This event marked the final abandonment of steam power by this company, as its remaining cable plants—those of the Castro and Pacific Avenue lines, have been operated by motors for several years.

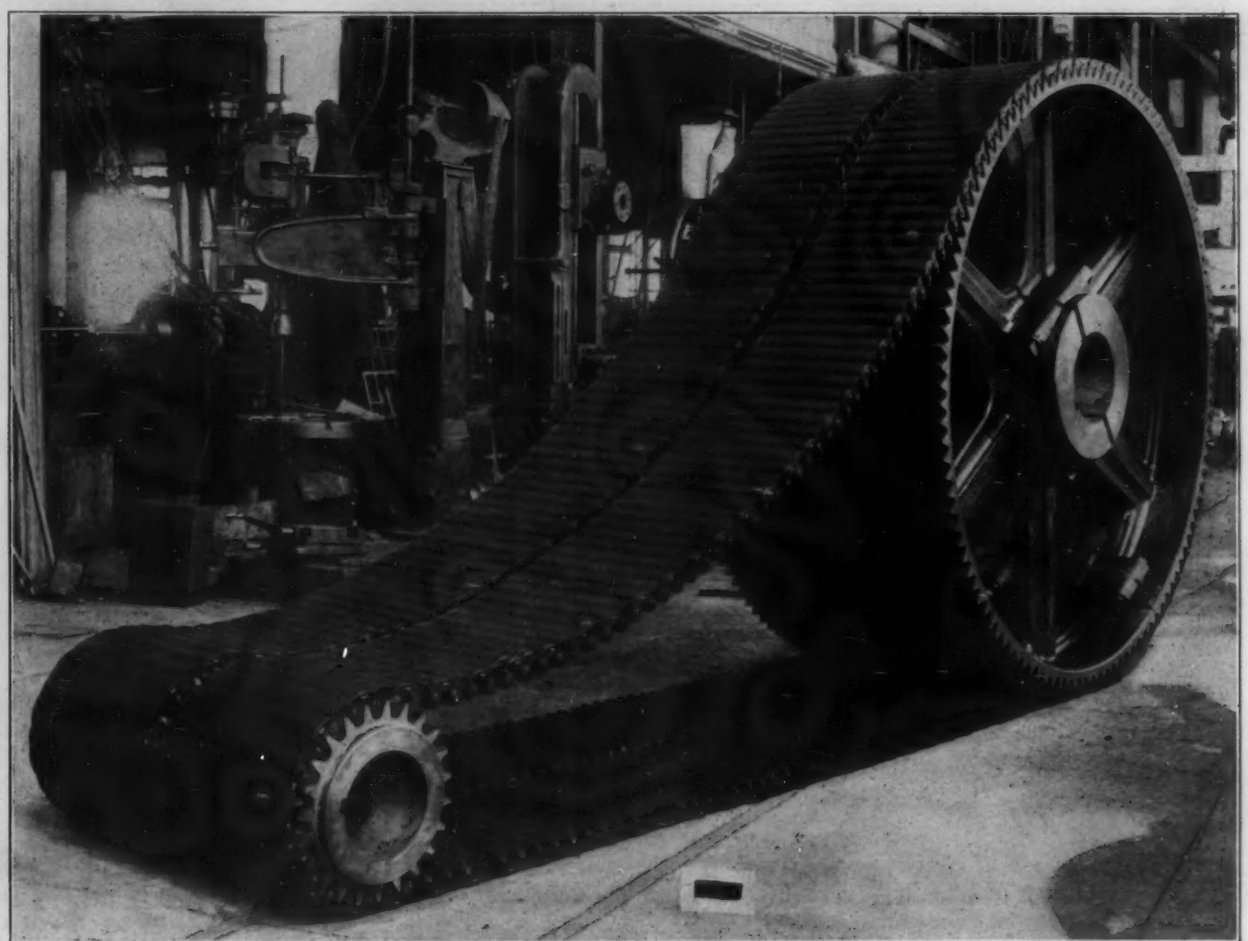

Fig. 1. Giant Morse Chain-Drive of the United Railroads. This is the Largest of Its Kind on the Coast and Next to the Largest in the World.

The engines which the electric motor has replaced at this plant have had an interesting history. Erected by the Risdon Iron Works in 1888 to take the place of the original vertical engines, they were rebuilt in 1893 to handle the longer ropes made necessary by extensions of the system. At that time their cylinders were enlarged to their present size 24 in. by 48 in. The catastrophe of 1906 buried them completely from sight, but they were excavated, overhauled by their original builders, the Risdon Iron Works, and set going again. For many months they ran in the open air with no protection save a flimsy canvas roof.

The steam plant consisted of twin horizontal en-

gines coupled to the same main shaft, each engine having 250 horsepower, making a total of 500 horsepower. The friction load of the cable and road machinery, with no cars on the line, amounted to 320 h.p. The friction load of the engine itself including cylinders, shafting, fly wheel, gears, pinions and winders, amounted to 40 h.p. Operating conditions require that the plant run continuously for 20 hours and 14 minutes per day, year in and year out. In order to bring the engines to a stop in case of emergency, the fly wheel—16 ft. in diameter and weighing 22 tons—was equipped with a hand operated band brake acting on about 1/3 of the circumference.

In designing the motor to replace these engines the operating conditions above described had to be met in every particular. In addition, to allow for repairs to the cables it was necessary that the motor be capable of being operated in either direction at half speed as well as full speed, under full load. It was required that the motor run for ½ hour at the former speed. A constant rope speed of 9.451 miles per hour with the absolute minimum of variation, was imperative. In order to save the high cost of converting machinery, alternating current was specified, this form of power being the most available at this location.

The first serious problem encountered, after the preliminary investigations were complete, was that of transmission. In order to leave adequate space for making repairs to the cables, the smallest motor available was necessary. The bulk and high cost of a slow speed motor made its use practically impossible; on the other hand, a high speed motor required a very large speed reduction. All the ordinary methods of transmission, such as belts and ropes, were found to be impracticable under the required conditions. After exhaustive investigations the field narrowed down to two methods—either a gear or a chain drive. Finally, on account of its noiselessness, low maintenance cost and high efficiency, a Morse chain was chosen.

The installation as shown in Fig. 2 consists of one General Electric 1-18-600 h.p.-400 r.p.m.-400 volts, Form M, induction motor, with master controller and contactors, and a set of 12 cast iron grid rheostats,

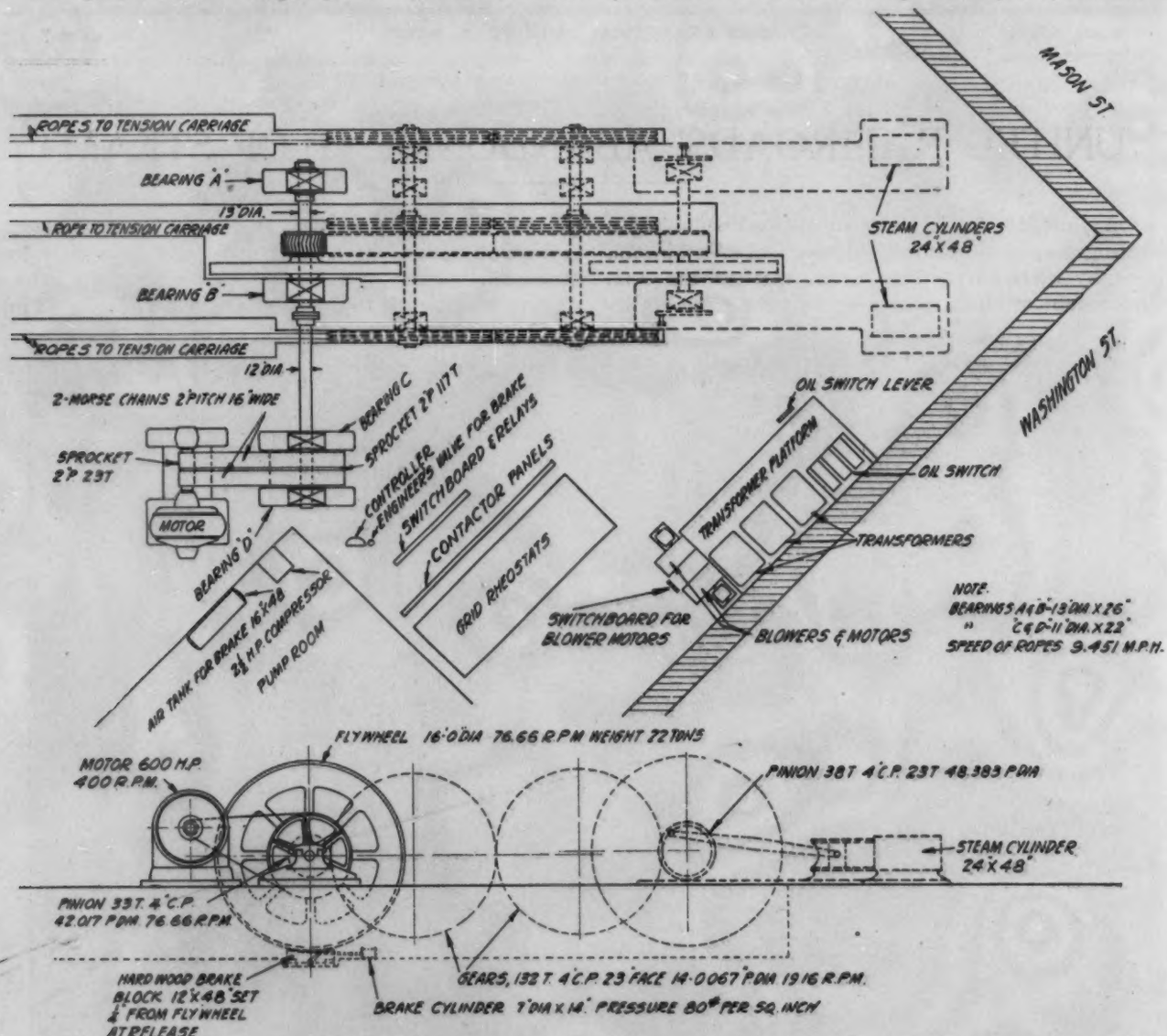
MASON ST
WASHINGTON ST
ROPES TO TENSION CARRIAGE
BEARING 'A'
13' DIA.
ROPE TO TENSION CARRIAGE
BEARING 'B'
ROPES TO TENSION CARRIAGE
12' DIA
2-MORSE CHAINS 2" PITCH 16" WIDE
SPROCKET 27 T 23 T
BEARING 'C'
SPROCKET 2" P 117 T
MOTOR
BEARING 'D'
AIR TANK FOR BRAKE 16"x48"
2½ H.P. COMPRESSOR
PUMP ROOM
CONTROLLER
ENGINEERS VALVE FOR BRAKE
SWITCHBOARD & RELAYS
CONTACTOR PANELS
GRID RHEOSTATS
STEAM CYLINDERS 24"x48"
OIL SWITCH LEVER
TRANSFORMER PLATFORM
OIL SWITCH
TRANSFORMERS
SWITCHBOARD FOR BLOWER MOTORS
BLOWERS & MOTORS
NOTE.
BEARINGS A & B-13" DIA X 26"
" C & D-11" DIA. X 22"
SPEED OF ROPES 9.451 M.P.H.
FLYWHEEL 16'-0" DIA 76.66 R.P.M WEIGHT 22 TONS
MOTOR 600 H.P. 400 R.P.M.
PINION 38 T 4" C.P. 23 T 48.383 P DIA
STEAM CYLINDER 24"x48"
PINION 33 T. 4" C.P. 42.017 P DIA. 76.66 R.P.M.
HARD WOOD BRAKE BLOCK 12"x48" SET ¼" FROM FLYWHEEL AT RELEASE
GEARS, 132 T. 4" C.P. 23" FACE 14-0067" P DIA 19.16 R.P.M.
BRAKE CYLINDER 7" DIA x 14" PRESSURE 80# PER SQ. INCH

Fig. 2. Floor Plan and Elevation of Washington and Mason Street Power House. Dotted Lines Show Old Work. Solid Lines Show New Work Required by Motor Drive.

the motor being mounted on a sliding base for adjustment of the transmission chain. Power is brought to the building at 11,000 volts, passing through a set of air cooled step-down transformers which reduce it to 440 volts. These transformers were taken from the sub-station at Turk and Fillmore streets, where they were used previous to the installation of modern motor generator sets at that point. They are cooled by two Sirocco No. 4 fans, each fan being operated by a G.E. 440 volt 1½ h.p. a.c. motor. These fans and part of the switchboard equipment are the only new material used on this part of the work.

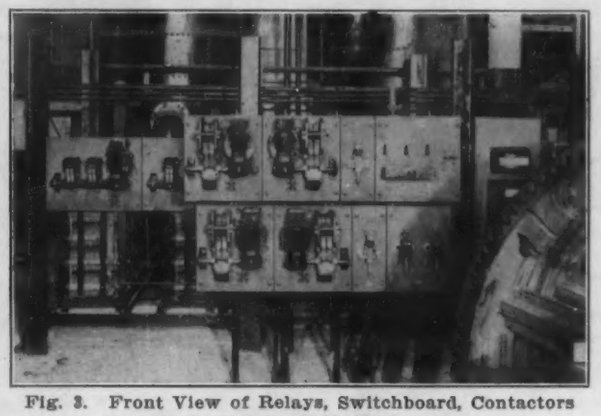

Fig. 3. Front View of Relays, Switchboard, Contactors and Cast Iron Grid Resistance.

The motor shaft carries the sprocket for the Morse chain; this sprocket contains 23 teeth, is 15.04 in. in diameter, with 34 in. face, made of semi-steel. The transmission link consists of two Morse Silent Chains, each 16 ft. wide, with 2 in. pitch. This drives a sprocket on the main shaft having an outside diameter of 74.87 in. with 117 teeth, giving a speed reduction of approximately 5 to 1. This chain is the largest on the Pacific Coast and the second largest in the world. In addition to the high speed ratio, the distance between sprocket centres 10 ft.—is unusually small.

The large sprocket drives a main shaft carrying a herring bone pinion 42 in. pitch diameter, 4 in. circular pitch, 33 teeth, which meshes into the twin gears of the winders. These gears have a pitch diameter of 14 ft., with 132 teeth. On the same shafts with these gears are the winders which carry the cable. These winders have a diameter varying from 13 ft. 9 in. to 13 ft. 6 in. due to the wear on the wooden lining of the grooves. The main shaft carries a fly wheel 16 ft. in diameter weighing 22 tons, which is a duplicate of the fly wheel used by the steam plant. This fly wheel is acted on directly by a specially designed air brake, shown in Fig. 5. All the foregoing equipment, with the exception of the motor, chain and sprockets, was second-hand, being part of the original plant or taken from abandoned plants owned by the company.

The brake consists of a hardwood block 4 ft. long and 12 in. wide, cut to the same radius as the fly wheel, having a minimum thickness of 12 in. This block, when in action, bears directly against the face of the fly wheel, being actuated by an eccentric lever connected to an air cylinder. The air cylinder carries a pressure of 80 lbs. per square inch, with a diameter of 7 in., giving a pressure on the brake lever of 3078 lbs.; as the levers have a ratio of at least 12 to 1, this

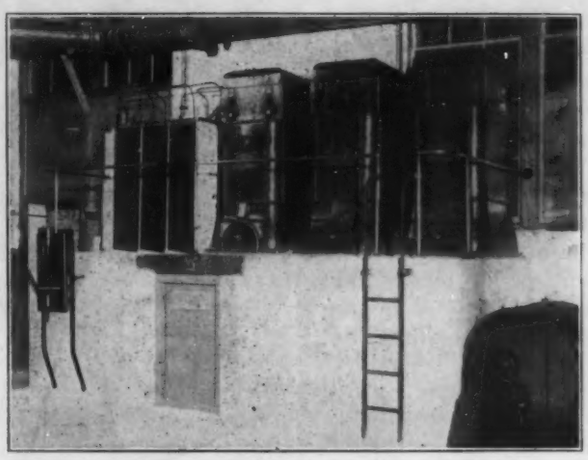

Fig. 4. Transformer Gallery Showing Oil Switches, Operating Lever and Blowers.

gives a braking pressure at the rim of the fly wheel of 37,000 lbs. By actual test this brake has brought the cable to a full stop in 12 seconds. The best time obtainable with the hand brake was 20 seconds. This is of great service in catching a broken strand before it gets out of the power house. All the air equipment described is identical with that used on the electric cars of the company, the brake being applied through an ordinary engineer's valve located beside the controller.

To allow for emergencies the steam engines are held in reserve, it being possible to disconnect the motor by throwing out the 33 tooth pinion and to connect the engines by throwing in a similar pinion at the steam end.

In operating the steam plant the cost per rated engine h.p. hour was 64 mills. With the electric plant the cost per rated motor h.p. hour is 58 mills. The comparative cost of lubrication cannot as yet be accurately determined, as the motor has not been in operation for a sufficient time, but a considerable saving in favor of the motor is expected.

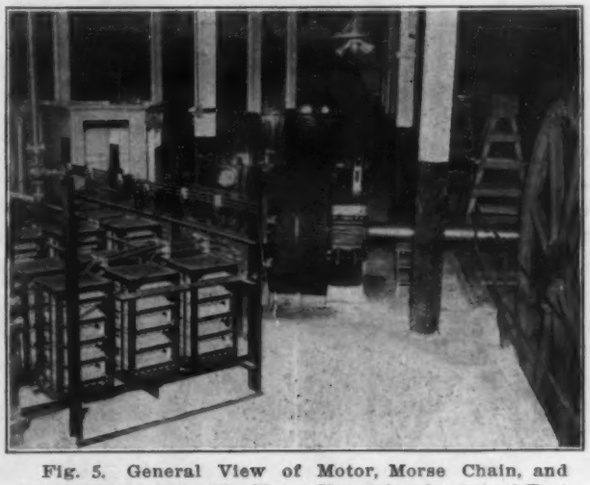

Fig. 5. General View of Motor, Morse Chain, and Driving Sprocket. The Motor Shown has by Actual Test Brought the Cable Ropes from Complete Rest to Full Speed in 40 Seconds.

On account of the more uniform speed of the motor, the wear on the rope has been greatly reduced and its life correspondingly lengthened. The same is

true of the wear on the grips. The steam engine, under a sudden increase of load, used to speed up and literally "chase" the cable until the governor acted, producing the surging and jerking of the cable that proved the chief objection to this form of traction.

The constant speed of the motor has several advantages in addition to those of a purely economic nature. The smooth operation has added greatly to the comfort of travel on the cable lines, has permitted a more rapid service and has enabled the cars to maintain the exact schedule during rush hours—a thing hitherto impossible.

out trouble, bringing the ropes from complete rest to full speed in 40 seconds.

The motor drives the entire cable system operating on Powell, Mason, Clay, Sacramento, Washington and Jackson streets. This consists of five 1¼ in. wire ropes of variable lengths, having a total length of 12.26 miles, with a net weight of 162 tons, operating a maximum of 32 cars.

We are indebted for the information contained in this article to B. P. Legare, engineer of maintenance of way and construction for the United Railroads. The entire layout was designed and installed by W. B. Far-

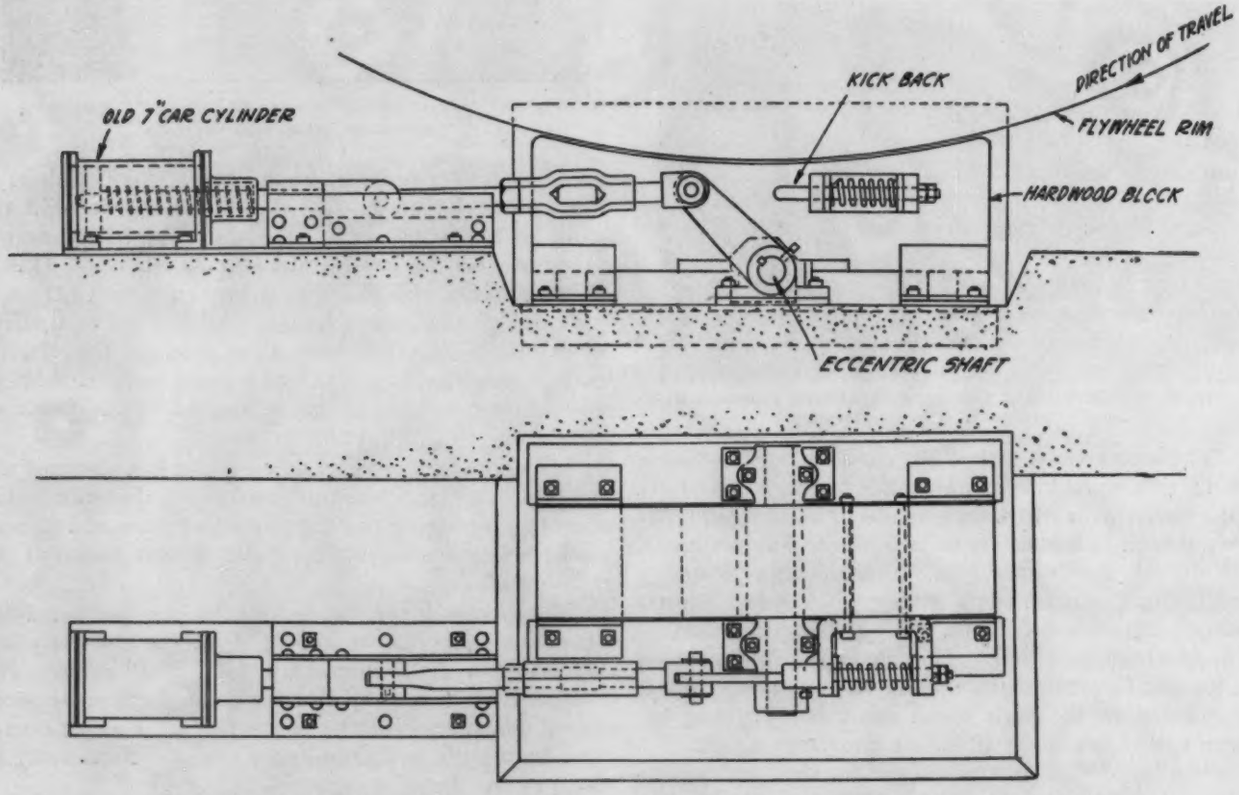

Fig. 6. View of Friction Clutch. But Twelve Seconds Required to Bring System to Standstill.

In excavating for the foundations of the main driving shaft of the motor plant the brick foundations and anchor bolts of the original vertical engines were encountered. As they were in excellent condition new threads were cut on the old bolts and collars fitted over them, which in turn engaged the anchor bolts of the shaft bearings. The collars and bolts were then embedded in concrete, forming a very satisfactory foundation.

For the first two days of motor operation the steam plant was not disconnected, for fear of a break down. This added to the ordinary load on the motor, the entire friction load of the steam plant with its fly wheel and gears, as well as considerable resistance due to the back pressure of air in the cylinders. In spite of this handicap the electric plant worked with complete smoothness from the start. After about three weeks operation the plant was shut down for 10 minutes at 3 o'clock in the afternoon to permit lubrication experts to examine the chain. This made it necessary for the motor to start the entire system, under full load, from a dead stop. It accomplished this feat with-

low, chief draughtsman of the department of maintenance of way and construction.

ENGINEERING APPLICATION OF BAMBOO WOOD.

In Java the Government engineers have recently constructed a road bridge, more than 100 feet long, with a central span of over 60 feet, entirely of bamboo. The road bed is composed of bamboo matting, which will be covered with a layer of dry earth. In profile the bridge resembles a steel structure, but all the members are bamboo rods. It is estimated that such a bridge should be good for 10 or 15 years. There are two kinds of bamboo used in building and cabinet-making in the East—one having solid and the other hollow stems. The solid, seen in Japanese furniture, is much smaller than the hollow, but both belong to the same species. In the construction of bamboo houses no nails are used. The parts are bound together with lashings formed from the skin of the bamboo itself.

NECESSARY AMENDMENTS TO MINERAL LAWS.[1]

BY G. O. SMITH.[2]

The increasing share which the United States Geological Survey has been asked to take in the public land administration by the Interior Department has brought many of the problems connected with the public land laws more directly to the attention of those charged with the work of this bureau. For over thirty years, however, these problems have interested the Survey geologists who have had exceptional opportunities for first-hand observation in nearly all the important mining districts of the country, and for almost as long a period the engineers of the Survey have been in touch with the irrigation and power developments in the public land States. This intimate experience with both field conditions and administrative problems justifies an expression of opinion which may be appropriate to this occasion.

The objects to be sought by amendment of the public land laws are, first, purposeful and economical development of resources for which there is present demand with retention of such control as may insure against unnecessary waste or excessive charges to the consumer, and second, the reservation of title in the people of all resources the utilization of which is conjectural, or the need of which at least is not immediate. The means that are essential to the attainment of these objects are, first, the classification of the public lands, second the separation of surface and mineral rights, and third, the disposition of the lands on terms that will secure the highest use, enforce development and protect the public interest. Legislation based on these principles will not only secure the positive benefits of immediate utilization but will also avoid the evils of speculative holdings of lands by fictitious use or by admitted nonuse, for the future enjoyment of the unearned increment or of the profits of monopolization. With actual development made a condition of possession, and with land classification and separation of estates made preliminaries of disposition, the present day utilization by individuals or corporations and the reservation to the people for future use become at once possible without conflict of interests.

The classification of the public land is essential to the administration of not only such laws as express the principle of separation but also of those whose purpose is to promote the highest use of the land. Land classification is first of all the determination of the best use to which each particular portion of the public domain can be put, and by the organic act of March 3, 1879, this duty was specifically imposed upon the Director of the Geological Survey.

Under the withdrawal act of June 25, 1910, classification is made possible in advance of disposition and disposition can be postponed to await needed legislation.

The second step, both in principle and practice, appears to be that of making possible by legislation the separation of surface and mineral rights whenever the two estates have values which can be separately utilized. A notable advance in public land legislation was the passage of the acts of March 3, 1909, and June 22, 1910, which provide that patents issued thereunder grant title to the surface of the land only and thus permit the agricultural development while at the same time the United States retains title to the underlying coal deposits.

On the subject of waterpower legislation the position of the Geological Survey is essentially that set forth in January of this year in a report addressed to the Secretaries of the Interior and of Agriculture by a joint committee representing the two Departments. The legislation there outlined would provide for lease of public and reserved lands of the United States valuable for waterpower development for a fixed term, not to exceed 50 years, with moderate charges for use and occupancy of the land, and revocable only upon breach of conditions or on account of the charge of excessive rates to consumers. These leases should be identical in terms, whatever the Department under which they are granted, with joint and uniform regulations governing all matters relating to waterpower development of land belonging to the United States. Provision should also be made for periodic and equitable readjustment of charges, transfer of lease, preferential rights to renewal, and compensation for improvements at the termination of the leasehold. The law should specifically recognize waterpower use as dominant and both insure to the lessee undisturbed occupancy of the land needed for such use and reserve for future utilization all the land believed to possess value for waterpower development, these lands to be designated by the President but to be open to other entry subject to this reserved right wherever separation of the waterpower use and other use is possible.

The chief advantage of land withdrawal and classification lies in the essential relation to the principle of proper disposition of the public domain, the real purpose of public land administration being to secure such reservation or disposal of the people's land as will assure its highest use. The question of amendment of the present laws relating to the disposition of coal, oil, gas, and phosphate deposits on the public domain is recognized as fairly before the public by the specific mention of these minerals in the Withdrawal Act.

The coal land law is unquestionably the most satisfactory of the present mineral land laws in that it admits of the placing of an adequate valuation upon the deposits, and in the administration of this law the purpose is not only to base the appraisal price upon the quantity and quality of the coal present and to give consideration to every known physical and commercial factor affecting the value of the deposits but also to make the selling price approach as nearly as possible the present purchase of a royalty under a leasehold. Thereby it is intended to permit purchase for immediate development and at the same time to prevent or at least discourage purchase for long-time investment or for monopolization. So many factors, however, require consideration that an ideal adjustment of the values is well nigh unattainable for many if not for most coal lands, and on this account a strong argument may be made for support of the lease over

[1] Abstracted from an address at the Twenty-first Anniversary of the Michigan School of Mines, Houghton, Mich., August 9, 1911.

[2] Director of U. S. G. S.

the sale system. Under leasehold it would be comparatively easy so to adjust the relationship between ground rental and royalty as to prevent the acquisition of coal deposits until such time as their development should be profitable. On the other hand, it is possible, under the present law, and it is the policy in its administration, to readjust the prices from time to time, either by reduction to encourage development in special cases or, more commonly, by raising the price on account of increased value due to new discoveries or to changed commercial conditions. Hardly less important, moreover, is the better control possible under a lease system, although against the advantage of such control must be weighed the cost of Federal management and the possibilities of inefficient administration or even maladministration. The present coal land law, however, has one serious defect, which should be remedied if a leasing law is not enacted. The restriction of area that may legally be acquired to a maximum of 160 acres for an individual and 640 acres for an association is not in accord with good mining practice. The fixed charges on the cost of a modern coal mine, provided with the up-to-date equipment necessary to conserve life and property and to assure maximum recovery are too high to be assessed against the tonnage of so limited a tract, especially if the coal seam is of moderate thickness. A law designed to promote the practical utilization of coal deposits, whether the system contemplates sale or lease, must provide for the holding of a large enough unit to permit the opening and equipment of a modern mine and to warrant its operation on an economical scale. Without such provision for commercial operation too great an advantage is secured to the land-grant railroads and large coal companies already in possession of considerable areas of high-grade coal.

The most urgent need of legislation for the disposition of mineral deposits is in the case of oil and gas. It is most apparent that the placer law, which is none too well adapted to meet modern conditions in mining placer gold, is wholly inadequate as a method of dealing with public oil lands, inasmuch as the discovery of oil is a late stage in the exploration and development of the land claimed under the law. Thus, large expenditures, extending over several months, if not years, are necessary before any right is acquired against the Government, and during all this time there is lacking any legal protection of the oil prospector against unscrupulous claimants or competitors better backed by capital. The need for remedial oil legislation is somewhat less acute than it was a year ago, by reason of the passage of the act approved March 2, 1911, the effect of which is to validate a class of claims which, while clouded by the construction which the Department was forced to place upon the misfit placer law, under which title to oil lands must now be made, were bona fide in that the inception of their development antedated the oil land withdrawals. This enactment was in accord with the spirit of the withdrawal act, which provides for the protection of equities already established.

The need for a better law is, however, imperative and the legislative action demanded by the situation should not be limited to an attempt to revamp the general placer law but should be the enactment of an altogether new measure, especially adapted to provide for the sane and equitable development of this industry in the future. First, the new law should authorize the issue of exploratory permits, granting to individuals or associations the exclusive privilege of occupation, the sole condition of such a grant being diligent and adequate prosecution of development work, measured by the expenditure of fixed sums within certain periods, with possibly the payment of a small fee to the Government in lieu of such expenditure during the first six months. The issue of this permit should preferably be limited to one to each citizen or association of citizens, although after the lapse or surrender of such a permit the former holder should be allowed to again apply for an exploratory permit. In the second place, the law should provide that upon discovery, the holder of the permit be given a leasehold title with a royalty varied to meet local and actual conditions. The "wild-catter," or prospector in unproved country, whether such unproved territory is classified on geological evidence as oil land or not, should be given special privilege to offset his greater risk. This privilege might take the form of an increased acreage, held both under permit and under lease, or a practical exemption from the payment of royalty, merely a nominal rental being charged under the lease. The chief advantage of the leasehold for oil over a fee simple title lies in the prevention of monopolization through large holdings. Such large holdings without production would be guarded against by a ground rental sufficiently high to discourage the acquisition of lands except for immediate and continued development, although provision should also be made in the lease for surrender under terms which would protect the Government. This indirect control of development would be preferable to the direct enforcement, by forfeiture, of continuous production, which should be avoided because of the danger of disturbing the delicate equilibrium between supply and demand. Transfers of interest, under either permit or lease, should be permitted because of the absolute necessity in most instances of securing capital for both drilling and operating an oil well. The law, however, should set forth the purpose of such control of transfer, which would be to provide protection for the original locators, most of them men of small means, and more especially to secure the prohibition of too large holdings of Government leases by big companies.

Whatever the details that may characterize this or that amendment to the public land laws, the essentials to be sought are development of those resources for which there is present need and the protection of the other resources for which there is no immediate demand. To this end the lawmakers in my opinion should concern themselves more in retaining such control as will prevent either nonuse on the one hand or waste on the other, than in devising means of increasing the public land receipts by heavy royalties on the producing coal mine or hydroelectric plant. Tax instead the idle property. Through the full development of the mineral industry, the nation can secure indirect benefits far in excess of any direct profits in the form of fees or rayalties.

TEST OF FIRE ALARM SYSTEM RECENTLY INSTALLED AT THE PRESIDIO HOSPITAL.

An automatic fire-alarm system has recently been installed at the Presidio Hospital. The installation covers practically all of the 39 government buildings in the hospital department as shown in Fig. 1.

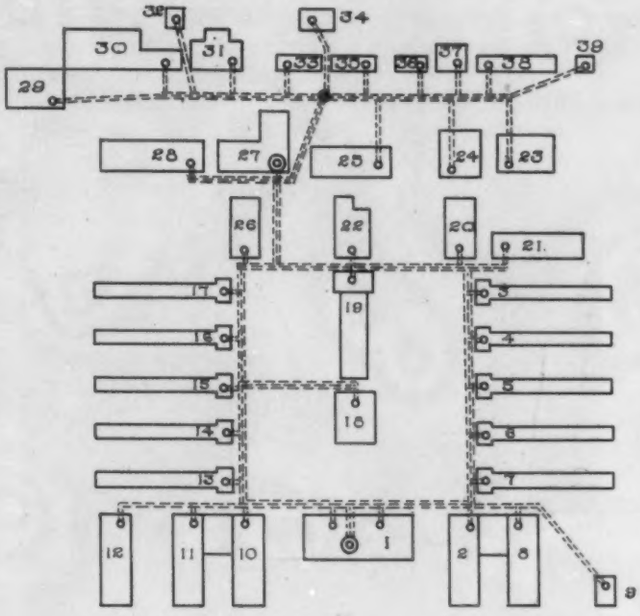

Fig. 1. Plan of Hospital Buildings at Presidio.

1. Administration Building (Main Alarm Station).
2 and 8. Barrack Quarters.
3, 4, 5, 6, 7. Wards.
9. Detention Ward.
10. Nurses' Quarters.
11. Post Exchange.
12. New Officers' Ward.
13, 14, 15, 16, 17, 20. Wards.
18. Operating Room.
19. Dining Room.
21. Electric Laboratory.
22. Kitchen and Store House.
23. Main Detention Ward.
24. Detention Ward.
25. Laundry.
26. Patients' Store House.
27. Power House (Main Alarm Station).
28. General Store House.
29, 30, 32. Stables.
31. Carpenter Shop.
34, 35, 36, 37, 38, 39. Store Houses.
33. Shops.

The system consists of small tubing encircling the ceiling of each room and also beneath the flooring and between the ceiling and roof. Within the 39 buildings equipped with the tubing, there are 55 separate circuits, each circuit covering a certain part of a building. An alarm bell is placed in an accessible place in each building which continuously rings in case of fire. Simultaneously an alarm is sounded in two main centers, which are the administration building and the power house. In these two buildings are placed a large 70 drop annunciator, designating the exact location of fire. At the same time a register tape registers the building on fire, while a large 10 in. gong strikes the number of building ringing in. One of these gongs is placed outside of the administration building, in order for everybody to hear the alarm. The source of power used in operating this system is

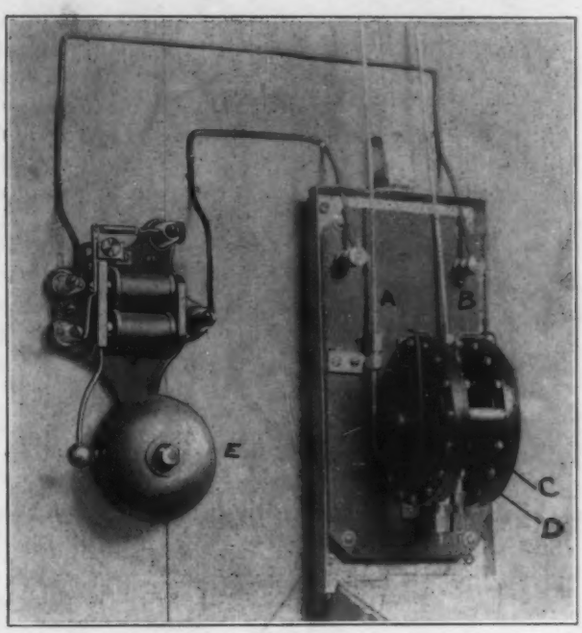

Fig. 2. Bell and Diaphragm for Fire Alarm.

by means of storage batteries, having two sets of batteries, with battery board to operate same, while one is in use, the other is on charge. By such arrangement there is always sufficient power to operate the system.

Fig. 3. Igniting Fire for Testing System.

The alarm operates by utilizing the expansion of air, due to heat, in a small tubing which is distributed on the ceilings of the risk to be protected. The

ends A and B of the tubing which has encircled a room to be protected, are connected to metal diaphrams C and D (see Fig. 2). Any sudden rise of temperature at any point of this loop is quickly transmitted to the diaphrams. This causes an unbalanced condition with the air from without pressing against the other side of the diaphram. This pushing of the diaphram to one side closes an electric circuit which sounds the alarms. One salient feature of the installation is found in the fact that even though a tube becomes broken or shattered by means of the double diaphram arrangement the alarm is still sounded. As a sudden rise of temperaature is necessary to operate the alarm in order to cause the unbalanced condition at the diaphram, although the diaphram is sensitive to a very small unbalanced temperature, yet exceeedingly hot weather will not sound the alarm for the diaphram has the same pressure within as without.

During the past week a series of tests have been put through in order to thoroughly try out the system. Fig. 3 shows a can with alcohol just about to be ignited. By careful scrutiny the small wire tubing can just be distinguished on the ceiling above. A series of alarms were sent in from various buildings within 25 to 40 seconds after the ignition shown. A tube was then cut and the alarm came through, though a few seconds later. After this experiment a regular bonfire was built in the barracks under the direction the Colonel in charge, burning from all variations of a small fire to a large blaze. When it assumed dangerous proportions the alarm was promptly sounded. The installation has been under the personal supervision of Gregg Curtin, Pacific Coast Manager of the International Electric Protection Company of New York.

WORK NORTH OF GATUN LOCKS.

Work has been begun on a coffer-dam which will be built across the north end of the lower lock at Gatun to prevent water from entering the lock pit during the removal of an earthen dike, containing about 500,000 cubic yards of material, which now serves as the only barrier. The arrangement will also permit of an uninterrupted continuance of operations within the lock while the removal of the dike is in progress. The site of the dam will be at the caisson sill of the lock, and the structure will be built of sheet piling, caulked and battened, supported by concrete piers, 43 feet high and 18 inches thick, spaced 10 feet from center to center. It will be of sufficient strength to resist a 40-foot head of water, which is about the depth of the existing artificial basin, north of the locks. When the dam is completed, a suction dredge will be brought up the French canal and through a small channel connecting it with the basin, and set to work on the dike, the material being wasted to one side. When the dredge has finished operations, it will be removed, the open water channel closed, and the pit unwatered and cleaned out, after which, the work of constructing the approach wall can be started.

HOOP SYSTEM OF DELIVERING ORDERS.

The method of using hoops has been in use on transcontinental railway service for years. It has not, however, been in general use in electric service.

Superintendent F. A. Boutelle of the Puget Sound Electric Railway has found it most convenient in the issuing of orders to express or limited trains. The

Fig. 1. Operation of Hoop System on Limited Trains.

hoop system as shown in the illustration of the limited between Kent and Tacoma, Wash., is used when orders are to be delivered, which do not require the signature of the conductor and motorman. In all orders, however, restricting the rights of trains, the motorman must stop his car and the crews sign the orders.

The hoops are made of very light wood and are held by the telegraph operator in a position where the conductor standing on the steps of his train can pass his arm through it and receives it in that manner. The stations are kept supplied with hoops by interchange—i. e. the conductor throws one off as he receives one from the operator.

BONUSES FOR MEMPHIS EMPLOYES.

On March 1, the Memphis Street Railway Company announced that all motormen and conductors who during the succeeding three months could show a clean record with no accidents or violations of rules should be awarded a bonus of one cent an hour. During the past three months the results have been satisfactory under this arrangement and the practice will be continued. The company has distributed $3500 among the employes, some of the crews having earned the bonus from the time the plan was inaugurated.

REDWOOD.

A recently published Agricultural Department bulletin by W. L. Hall and H. Maxwell on Uses of Commercial Woods of the United States, is of much interest to users of redwood.

Redwood has a dry weight of 26.2 pounds per cubic foot, a specific gravity of 0.42, ash 0.14 per cent dry weight of wood, a fuel value 57 per cent that of white oak, a breaking strength of 8000 pounds per square inch and a factor of stiffness equal to 1,140,000 pounds per square inch.

In character and quality it is light, soft, moderately strong, brittle, grain fine, even, straight, sometimes curly; annual rings wide in the young timber, summerwood thin, dark colored, hard, conspicuous; medullary rays numerous, very obscure; color light to dark red, the thin sapwood nearly white; splits and works easily and polishes well; very durable in contact with the soil.

In growth it reaches a height of 180 to 280 feet, occasionally over 300; diameter 6 to 10 feet, sometimes 15.

The redwood belt extends in a strip 500 miles long from southern Oregon to central California. The strip is narrow, ranging in width from 10 to 30 miles. The commercial range has been estimated to cover 3000 square miles, but the dense logging woods cover a much smaller area than that. The estimates of the merchantable stand vary. In 1880 the Federal census placed it at 25,825,000,000 feet. More than 20 years later, upon fuller information, private estimates doubled that amount, notwithstanding much cutting had been going on for years. The heaviest stand is near the center of the redwood region, in Humboldt County, Cal., though very dense forests exist both north and south of that point. It is not unusual for 50,000 feet to be cut from a single acre, and often three times that. Single trees of enormous contents have been reported, and it is probable that no other timber in this country can show larger yields per acre.

Mature trees attain an age of from 500 to 800 years. The oldest reported was 1373 years, so that redwood does not attain to the great age of the big tree of the Sierra Nevada Mountains. Redwood trunks 20 feet in diameter, with heights of 300 feet or more, have been measured, but the average is much under that, ranging between 6 and 10 feet. When a tree passes the age of 500 years it is liable to die at the top.

Redwood is one of the few soft woods that reproduces bountifully from sprouts. Few trees surpass it in that particular, and the vigor of the sprout growth is remarkable. A large portion of the forest is renewed in that way, and the largest trees retain their ability to send up shoots from the stumps.

The splendid redwood was inviting to the early settlers of the region, and they put to use as much of it as they needed. The Spaniards cut sparingly, because they wanted little. They were moderate users of lumber, and for their more pretentious buildings preferred adobe or unburned bricks. They found places for a few heavy beams in their churches and mission buildings, but the majority of these structures were in central and southern California outside the redwood belt, and very little redwood found place. The Russian settlers cut considerably more, but their total cuttings were not sufficiently extensive to make an impression upon the hundreds of square miles of that timber near the California and Oregon coasts.[1]

Settlements of Americans were planted very rapidly after the discovery of gold, and sawmills in the redwood region put in their appearance about 1850. Lumber was cut for houses, barns, fences, and other farm uses, and a small amount of it found its way to the mines, where it was made into sluice boxes, rockers, sheds, and other mining appliances and appurtenances. But the principal mining fields were not near the redwood forests, and the use of the wood by the placer miners was the exception rather than the rule. In some instances boats were made of it, but it was not esteemed for that purpose as highly as Port Orford cedar, which was abundant about Coos Bay in southwestern Oregon. The chief demand for redwood during the early years was as ranch material. The earliest operations by sawmills were south of San Francisco and immediately north of it. It is said that the first cargo of redwood shipped from the Humboldt Bay region was in 1855, though fir and pine were shipped from there earlier. The cargo amounted to 200,000 feet, and went to San Francisco. The earliest operators picked small redwood trees because their primitive mills could not manufacture those of large size. During the Civil War circular saws began to replace the muley saws of the pioneers, and large timber could be handled.

A redwood picket fence at Santa Cruz, Cal., was said to have remained sound 61 years, and in the vicinity of old Russian settlements fence posts are shown in fairly good condition which it is claimed were placed there almost a century ago. That is proof not only of the lasting property of the wood, but also indicates that it was a fence material at an early date. Pioneers put it to use also for poles, grapevine stakes, wharf piles, piers, and supports for bridges, and well curbs. Though the best of the wood resists decay many years on land or in fresh water, it offers little resistance in salt water when attacked by the teredo or other marine borers. The tannin or other acid which the wood contains is credited with rendering it immune from ravages of land insects and fungus, but salt water apparently leaches the substance out in a short time and leaves the wood defenseless. For that reason piles, wharves, cribs, piers, and sea walls built of redwood in early times have not survived in salt water as well as in fresh.

In 1902 the Southern Pacific Railroad had in its tracks west of El Paso 12,000,000 redwood ties. That was twice as many as the ties of all other woods combined. Where the traffic is moderate, and where plates are used between the rails and the wood, these ties last 8 to 10 years. If plates are not used the iron rails cut them rapidly. In most cases a redwood tie wears out before decay renders it useless. Where traffic is

[1] Documentary evidence of the Russians' activity in cutting redwood is not abundant but numerous sawpits and stumps evidently cut long ago about Fort Ross and Bodega Bay are said to date from the days when the Muscovites in California manufactured redwood lumber with whipsaws.—"Souvenir Humboldt County," California, p. 3.

light, as on side tracks and switches, the wood gives service two or three times as long as in main lines. Instances have been cited where redwood ties in California were in daily use for 25 or 30 years, but in those cases mechanical wear was small.

The spike-holding properties of redwood are only fair. Softwoods are generally inferior to hardwoods in that respect, and redwood is in the class with average softwoods. The ties are not only extensively used in California and west of the Rocky Mountains, but they are found in considerable numbers in the railroads of Mexico, Peru, Chile, and even in India. One of the chief properties recommending this timber in some foreign countries is its immunity from attack by ants. The coloring substance in the wood is supposed to be the cause of it, and this timber is often, perhaps always, untouched where other timbers may be devoured. The advance in redwood prices in recent years has excluded it from some regions as a tie material.[1]

Railroads employ redwood for many purposes other than ties. It is an excellent culvert timber, because of its resistance to decay. For the same reason it goes into trestles and bridges in positions where strength is not the chief essential. In sheds, warehouses, and buildings of various kinds it is often selected for the foundation material, sills, sleepers, and pieces near the ground. It is used for car roofs, siding, and interiors. The characteristic which fits it specially for these purposes, is its small tendency to shrink or swell. This is important in freight-car material, which is liable to pass in a few days from dry summer heat to cold mountain rains or snows, or into fogs, and back again into dry airs. Redwood stands that test in a way highly satisfactory. It holds paint well, which lessens repair bills. Redwood in freight cars has given 20 years of service, a record that will compare well with that of any other wood.

The industries of the Pacific Coast, and in a lesser degree of the whole country, owe much to the good qualities of redwood as a material for tanks, vats, flumes, conduits, and other structures of that class. Railroad water stations in California, Arizona, and Nevada are well equipped with tanks of this wood. They are frequently a part of municipal waterworks. Eureka, Cal., some years ago built a tank 30 feet high, 54 feet in diameter, and with a capacity of about 584,000 gallons, and later added another of equal capacity. When redwood is first used for holding or conducting water the fluid is stained by the coloring matter leached from the wood, and the same result is seen when water flows from a new redwood roof. In a short time, however, the water clears and no unpleasant results follow.

The wine makers of California equip their cellars with redwood tanks for storage purposes. For this class of heavy cooperage it is one of the best obtainable materials. The density of the wood is sufficient to prevent leakage; the grain is straight, making it easy to work; it gives long service; and is not liable to be attacked by boring insects which sometimes riddle pine tanks. Tanners' vats of redwood last a long time, and the wood resists the action of tanning solutions. Redwood vats also meet the trying demands in cyanide plants where ores are separated.

Some of the finest, largest, and best-built wooden water pipes and conduits are of redwood. It meets requirements so well and in so many ways that large use of it is made hundreds and even thousands of miles from the source of supply. The staves are fitted and joined so accurately that leakage is little more than from iron, and it is claimed that the wood is so much smoother that a given pipe will carry more water than one of metal. This is particularly true after the two have been some years in use. The wood grows smoother by wear and the iron rougher by corrosion and accretions. Pipes from 8 inches to 9 or 10 feet in diameter are in use, and single pipes have been built 20 miles long. Redwood pipes and flumes of this kind have been constructed as parts of municipal water plants or of manufacturing concerns or mines in all portions of the United States. The staves are generally shipped ready manufactured, though some fitting is done on the ground. The pipes are bound with iron hoops. It is possible to carry such flumes across ravines or trestles, or under the ground, and if necessary they can rise above the level or sink below it like a siphon.

Brewers coat their redwood tanks with shellac on the inside to prevent direct contact with the wood. Such receptacles are widely used, not on the Pacific coast alone, but in Milwaukee, Chicago, Cincinnati, and other eastern and central cities.

Aqueducts and flumes in connection with irrigation canals are frequently of redwood. In that capacity redwood has figured perhaps more largely than any other timber in the development of irrigation in California. It has given much satisfaction in the construction of large outfall sewers, where resistance to decay is of much importance. Redwood water pipes, built of staves and banded with metal hoops, are used in many parts of the country.

Redwood gutters and eave troughs for houses are widely used, not only in California, but in distant regions.

Redwood has long had the reputation of being one of the slowest woods to burn, and for that reason one of the safest materials for wooden houses. It does not kindle in a blaze quickly, and so absorbent is the wood that it takes in water almost immediately, so that a redwood house on fire may be saved when a pine building in the same situation could not be. It is not denied that redwood houses will burn, but it is asserted that they are less liable to burn than buildings of most other woods.

As in house construction, so in interior finish, redwood meets almost every use and requirement. Floors and ceilings are made of it, and wainscoting, panels, moldings, chair boards, brackets, shelves, railing, stair work, spindles, balustrades, and mantels.

A small quantity of redwood furniture has been on the market since the wood first came into use, but

[1] Twenty years or more ago it was not unusual in central California, near the lines of the Southern Pacific Railroad, to find numerous fields and corrals inclosed by fences with redwood posts which had served as railroad ties until too badly worn for that purpose. When the railroad removed them from the track the vineyardists and stockmen hauled them away, and splitting them made two posts from a tie and got many years of service from them.

in recent years the demand has greatly increased. Two distinct patterns of this furniture are made—that which is without figure in the wood, but with pieces and panels broad, ample, and in appearance homogeneous, and that made of figured wood.

Redwood shakes have been a merchantable commodity for 60 years in California, and have sometimes been shipped elsewhere. They are usually split from straight, perfect wood and are used for covering buildings and as siding for barns and sheds. In size they are smaller, but in use very similar to the clapboards formerly employed in the Eastern States as roofing for log cabins and other buildings. The split shake is a wasteful product, and its diminishing use is not a matter for regret. In recent years, however, there has been a tendency to saw shakes instead of splitting them. Sawed shakes were not unknown 20 years ago, but they were not much used. Some of the shingle mills have added shake saws and find them profitable. The product can be made from any wood that will make shingles and no account is taken of cross grain. The waste compared with that resulting when shakes are split is reduced to a minimum.

Redwood has been tested to some extent for paving blocks. After 15 years' service pavement of this wood has been found in fairly good condition. In this, as in many other of its uses, its resistance to decay is among its chief recommendations. It has others, however, for its softness makes it easy under horses' feet and it is nearly noiseless.

Pattern makers draw upon redwood for supplies. It has not the exclusive field even among California woods, sugar pine being a competitor, while in the East it competes with yellow poplar, basswood, and white pine. Some large manufacturers prefer redwood for this purpose, and it seems likely to gain rather than lose as a pattern material in foundries, machine shops, shipyards, and other factories and shops.

It goes to New York and other eastern cities for tobacco boxes. Comparatively few woods meet the exacting requirements insisted upon, which is that they must not impart taste or odor to the tobacco. Formerly sycamore was almost the exclusive wood for these boxes, but others have come in, notably tupelo, and now the California redwood has successfully met the requirements.

Cigar-box makers are not so choice in material as are the manufacturers of boxes for plug tobacco. Appearance has much to do with their choice, and redwood is meeting the Pacific Coast's cigar-box makers' demands.

Redwood box lumber competes with sugar pine and other coast softwoods for fruit boxes. Its dark color is sometimes objected to because it increases the difficulty of doing good stenciling. When both redwood and white fir are convenient and available, many fruit packers prefer the latter for boxes.

Musical-instrument makers do not appear to have drawn heavily upon redwood, probably because the manufacture of musical instruments is not a highly developed industry on the Pacific Coast. It is listed, however, as a piano wood by Massachusetts manufacturers.

A small quantity of this timber goes to the makers of wagons and carriages and is worked into tops, chiefly light bodies, seats, dashboards, or in panels for business vehicles, such as bread, butcher, and laundry wagons. The liability of the thin boards to split under a blow tends to limit their use, but that there is demand for them is evident from the fact that they are used in shops thousands of miles from the native timber belt.

Coffins of this wood are largely used on the Pacific Coast, where they compete with those of the native cedars.

Before slate and composition blackboards for schools had largely taken the place of all other kinds redwood held a sort of monopoly for extra widths. One piece was enough for an entire board, and splicing and joining were not necessary. It was little trouble to procure planks 4 or 5 feet wide and as long as necessary. This timber has been sawed in planks 10 feet wide.

Shop signs painted on redwood are occasionally seen in England, and the wood is also used for lining cabinets, boxes, compartments, and drawers. Its use has been reported for lead pencils and champagne corks in Germany. The pearl divers of the Society Islands make of three redwood planks boats, with outriggers, which navigate the lagoons and shoals during the diving season.

Tests of paper making from redwood indicate that the enormous waste about the mills and logging operations might be turned to account. The wood is cooked with caustic soda, and the black liquors from the digesters carry away the coloring matter from the pulp, which is then ready for paper making. The article thus made resembles, it is said, the grade known as butcher's paper rather than print stock.

The black liquor from the digesters is concentrated to the consistency of asphalt, then roasted and reduced to gas, similar to natural or coal gas. It may be used for illumination, for operating gas engines, or for fuel. One ton of redwood scrap from the mill is said to yield 500 pounds of pulp and 10,000 cubic feet of gas. This gas, if used in an engine, would probably furnish enough power to run the mill. It was estimated in 1907 that the waste from the redwood mills in the region of Humboldt Bay amounted to 560 tons weekly.

Redwood bark is used in a small way for many purposes—some useful, others merely ornamental. Novelty stores and souvenir stands along routes of travel in the redwood region, as well as in San Francisco and other Pacific Coast cities, exhibit many bark commodities for sale, including pincushions, penwipers, table mats, lamp mats, doilies, moisture-proof match safes, seat mats, bathroom mats, and silk-hat brushes. The bark is also used for fishing floats, temporary cork, life-buoy filling, cork jackets, cold-storage insulation, heat insulation, house sheathing, bicycle grips, mattress fillings, cork carpet substitute, and sound-deadening insulation. In small towns in the redwood region it is not unusual to lay sidewalks of wide pieces of redwood bark. Such walks are dry and moderately lasting.

The enormous size of redwood timber makes its lumbering wasteful. Sometimes very large trees crush

so completely when they strike the ground that little saw timber can be saved. The weights of the very large trees run from 500 to 1,000. Much experience and skill are needed in cutting them down. A mistake of a few yards in the direction in which they are thrown may entail an unnecessary loss of $100 or more. The debris that strews the ground when one of the 300-foot giants falls is "shoulder deep." However, more careful methods prevail than formerly. It is customary to clear a space and prepare a bed for the tree to fall in, and experienced choppers usually are able to lay the trunk where they want it. It is still the custom of loggers to peel the logs and then burn away the bark and other debris to facilitate getting them out. Often the logs are badly burned. The loss from this proceeding is very large, as much of the standing timber within reach of the fire is killed and the humus destroyed.

Many other wastes were once common, and some of them still are, but the tendency is toward better methods. Crooked and defective logs were abandoned, though they might contain thousands of feet of good lumber. Enough small timber was frequently cut for skid roads and in clearing away to stock a sawmill. In floating down rivers to the mills many logs sank and were lost, and others went to the sea.

Other items, enormous in the aggregate, figure in redwood waste and loss. Large logs are often split with powder to make them convenient to handle. This damages some the best wood. A large percentage of the trees are wind-shaken, and pin rot affects many. The defective wood and often good wood near it have been thrown away. Increasing demand, however, has caused more attention to be shown to the waste heap, and what will make lath, shingles, shakes, and ties is manufactured into those commodities and others of like kind.

PRODUCTION OF PIG IRON BY ELECTRICITY.

The first report of the experiments in the reduction of iron ore in electric blast furnaces at Trollhatten, in the Gothenburg consular district, has now been made public.

The total cost of the plant was 320,470 crowns ($85,886), which was $26,800 more than the original estimates. On the basis of the selling price for the product, which was established by the committee in charge as a basis for computing the practicability of the results, the experimental business has, however, been self supporting, even for the short period that it has been in operation.

Special attention has been given to the constructive details of the furnace, the consumption of electrodes, and best form of these to use, the consumption of electrical energy per ton of iron produced, the consumption of coal for the same, and the important problem of gas circulation and possible utilization to best advantage. In charge of these experiments have been a chief engineer, with operating engineers under him in charge of actual operation, collection of data, chemical laboratory, and drawings and calculations—in all, twenty-eight men.

SPECIFICATIONS FOR PURCHASE OF FUEL OIL BY BUREAU OF MINES.

In determining the award of a contract, consideration will be given to the quality of the fuel offered by the bidders, as well as the price, and should it appear to be to the best interest of the Government to award a contract at a higher price than that named in the lowest bid of bids received, the contract will be so awarded.

Fuel oil should be either a natural homogeneous oil or a homogeneous residue from a natural oil; if the latter, all constituents having a low flash point should have been removed by distillation; it should not be composed of a light oil and a heavy residue mixed in such proportions as to give the density desired.

It should not have been distilled at a temperature high enough to burn it, nor at a temperature so high that flecks of carbonaceous matter began to separate.

It should not flash below 60 degrees C. (140 degrees F.) in a closed Abel-Pensky or Pensky-Martens tester.

Its specific gravity should range from 0.85 to 0.96 at 15 degrees C. (59 degrees F.); the oil should be rejected if its specific gravity is above 0.97 at that temperature.

It should be mobile, free from solid or semi-solid bodies, and should flow readily, at ordinary atmospheric temperatures and under a head of 1 foot of oil, through a 4-inch pipe 10 feet in length.

It should not congeal nor become too sluggish to flow at 0 degrees C. (32 degrees F.).

It should have a calorific value of not less than 10,000 calories per gram (18,000 British thermal units per pound); 10,250 calories to be the standard. A bonus is to be paid or a penalty deducted according to the method stated under Section 21, as the fuel oil delivered is above or below this standard.

It should be rejected if it contains more than 2 per cent water.

It should be rejected if it contains more than one per cent sulphur.

It should not contain more than a trace of sand, clay, or dirt.

Each bidder must submit an accurate statement regarding the fuel oil he proposes to furnish. This statement should show: The commercial name of the oil; the name or designation of the field from which the oil is obtained; whether the oil is a crude oil, a refinery residue, or a distillate; the name and location of the refinery, if the oil has been refined at all.

The fuel oil is to be delivered f.o.b. cars or vessel, according to the manner of shipment, at such places, at such times, and in such quantities as may be required, during the fiscal year ending .....

Should the contractor, for any reason, fail to comply with a written order to make delivery, the Government is to be at liberty to buy oil in the open market and charge against the contractor any excess of price, above the contract price, of the fuel oil so purchased.

Copies of this technical paper may be obtained by addressing the Director of the Bureau of Mines, Washington, D. C.

MUNICIPAL PURCHASE OF SEATTLE, RENTON & SOUTHERN RAILWAY CO.

On July 11, 1911, the following communication was addressed to Wm. R. Crawford, president and general manager of the Seattle, Renton & Southern Railway Company by the city engineer and the superintendent of public utilities of Seattle:

Dear Sir:—Ordinance No. 26069 of the City of Seattle, entitled:

"An ordinance declaring the advisability of a city electric railway on Rainier avenue and other streets, avenues and ways, and providing for the same, specifying and adopting the system or plan proposed, declaring the estimated cost thereof, as near as may be, and providing for the submission of such system or plan and the incurring of an indebtedness therefor to the qualified voters of the city for their adoption and assent thereto, or for their rejection thereof, at a special election to be held on the day of the general city election on the seventh day of March, 1911."

became effective February 9, 1911, and in conformity with Section 5 thereof, an election was held on Tuesday, March 7, 1911, and the qualified voters of the city on that date authorized the incurring of a general indebtedness of the City of Seattle in the sum of $800,000 for the purchase of the electric street railway system owned and operated by your company within the limits of the City of Seattle.

Under Section two (2) of this ordinance an appraisal of your street railway property by the Board of Public Works, was directed for the purpose of ascertaining its value and the Board of Public Works was further directed to certify such appraisal to your company for its consideration and acceptance.

Acting under the authority of this section the appraisal specified was made and the Board of Public Works approved same on June 30, 1911, and forwarded it to the City Council of the City of Seattle, which on July 3, 1911, adopted Resolution No. 3264, vesting authority in the Board of Public Works to certify such appraisal to your company.

The Board of Public Works at its regular session Friday, July 7, 1911, acting under the authority of this council resolution, authorized and directed the undersigned city enginer and superintendent of public utilities to certify the appraisal to your company and we hereby certify that we find the value of your holdings and your electric railway system within the limits of the City of Seattle, to be as follows:

Track	$198,286.45
Machinery and buildings	41,879.75
Rolling Stock	130,887.49
Real estate	15,000.00
	$386,053.69

and submit for your consideration and acceptance this appraisal to you in the name of the City or Seattle as a fair and just valuation of all the street railway tracks, poles, wires, feeder systems, barns, shops, substations, appurtenances and rolling stock as shown by inventory and appraisal herein before mentioned belonging to your company, which lie within the limits of the City of Seattle.

Under the terms of said Ordinance No. 26069, you are allowed sixty (60) days to accept the above offer and failure to accept same within said time will be considered as a rejection thereof.

Should you consider this offer favorably, arrangements for running rights, specified in Section two (2), will be made for the portions of your electric street railway system unacquired.

Transmitted herewith is a copy of inventory and appraisal of those portions of your railway within the limits of the City of Seattle made by the Board of Public Works.

Very truly yours,
(Signed) R. H. THOMSON,
City Engineer.
(Signed) A. L. VALENTINE,
Supt. of Public Utilities.
Seattle, July 12, 1911.

A copy of the above letter and inventory received on this 12th day of July, 1911, at 12 o'clock noon.
(Signed) W. R. CRAWFORD,
President Seattle, Renton & Southern Railway Co.

Under the terms of the offer the company is allowed sixty days in which to accept or refuse, and if refused the city is authorized to acquire it by condemnation.

A. L. Valentine, superintendent of the department of public utilities of Seattle, states that while the total track appraisal is only $198,286 for approximately ten miles of line, that a single section of 5177 feet of double track paved construction, put in recently, was appraised at $81,164, the material being estimated at $65,898 and the labor at $15,266. The figure on machinery and buildings may seem low, but is explained by the fact that the company buys its power from a local electric light and power company.

The outcome will be watched with much interest by the entire transportation fraternity on the Pacific Coast.

FUEL-OIL AND PETROLEUM INDUSTRY IN CANADA.

BY FELIX S. JOHNSON.

The petroleum wells of Ontario last year yielded 14,723,105 gallons of oil, valued at $559,478. This is a decrease of 3,756,442 gallons as compared with the production of 1908.

There was a diminution in the output of every one of the fields, but the rate of decline in the newer districts of Tilbury and Romney was greater than in the older districts of Petrolea and Oil Springs. Already the production has sunk to less than one-half of what it was fifteen years ago, and if the falling is maintained the supply of domestic petroleum will become relatively insignificant, unless new reservoirs are opened up. Even now more crude oil is imported than is produced in Ontario. The fields of Lambton county have been in operation a long time, and are unique because of the small individual production of the wells, which is only a few gallons a day, and of the economy with which they are operated. Being shallow, many wells may be worked by one engine on the "jerker" system, and so give a profit which if not large is constant.

The refineries, of which there are two in Ontario, distilled a total of 35,530,918 gallons of crude oil last year. Of this, 16,015,527 gallons was domestic and 19,515,391 gallons imported.

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Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Public Lands Necessary Amendments

Elsewhere in these columns will be found an abstract from the scholarly dissertation by the Director of the United States Geological Survey on necessary amendments to laws governing the acquiring of title to lands and power sites on the public domain.

The paper touches upon practically all the problems in the acquiring of title to public lands and is of vital interest to Western men. The suggestions of amendments to control oil and gas entries on the public domain are of great importance and should have the thoughtful consideration of all.

The paper does not, however, touch upon the present state of affairs in Alaska. Poor old Alaska—rent both at home and in congressional halls with dissensions and thus one of the most promising fields for national development and progress is in serious jeopardy of being crushed out by dire neglect and improper nurture. If improper means were attempted in her internal development, let us get the right method and get it quickly. If a boatman capsizes through an error in steering his canoe and is pulled out unconscious, give him a new start, resuscitate him, cure him. Don't treat him as we treat the pig, kill him first and cure him afterwards.

Technical Editors' Community of Spirit

For those engaged in a common calling it seems to be an unmistakable trait of the human race to feel the hidden intangible impulses and yearnings of comradeship, one for the other. We have all felt its charms. In his treatise on the expansion of England, J. R. Seeley has said that "there are in general three ties by which States are held together, community of race, community of religion, community of interest." On all sides we can see this subtle influence asserting itself in even much smaller units than the body politic of a State. The college student, for instance, feels it in his innermost and attempts to relieve his inexpressible pent-up feelings by yells unintelligible.

To those engaged in journalism and more particularly in its technical branch, the community of spirit is felt more strongly than in any other calling. Each week the mails are read with the deepest pleasure and silently but unfailingly we greet our editorial acquaintances of the past week. Like the good shepherd who performs the apparently impossible task of calling by name each ward within his care, we learn to designate the character and ideals of the individuals who pen the editorials. The mute lines speak traits of minute feeling which years of personal acquaintance could not fathom. The very choice of words identifies its writer as surely as the imprinted thumb marks will identify the individual. We learn to like, yes even to love, our friends with whom week by week we thus commune. Each week we renew our acquaintance

with our New York friends, The Electrical World, The Electric Railway Journal; our Chicago friends, The Electrical Review and the Electric Traction Weekly, and a number of others distributed far and wide in our country and abroad.

The whole Pacific Slope yearns to express to the world in 1915 the true spirit of the West. Our great exhibit and the hustle and bustle of a western metropolis will do much in the outward demonstration of this spirit, but after all it is the individual tapping at the hearts of men that express the enterprise and spirit of the West most fully. To you, our brothers of the technical press, the Journal this early extends its invitation to visit us and plan with us to enjoy a breath of our invigorating Western life. We have a place reserved for each and every one of you, a place high in our estimation and hidden in the recesses of the human heart.

To our New England friend who inwardly thinks technical learning was never taught correctly beyond the Hudson river; we will take you into the heart of the Sierras and high Rockies and show you the triumphs of engineering that have been accomplished by Western engineers and western graduates. To our middle westerner, who has put Niagara Falls so high in his estimation of God's creations; we will endeavor to show you that perhaps you cannot call it undignified if some of our hydraulic performances should be mentioned by a foot-note at least to a page for Niagara. To our friend who writes the staid, dignified editorials; we will lengthen your life by giving you an insight into a little bit of breezy Sanguinettie's on Saturday night. To our young editor friend just from the gay summer's outing at Coney Island and flashy eastern beaches; we will tame you down by taking you to Santa Monica, where recent laws almost require the wearing of overcoats and other costumes grave. And last, but by no means least, we want you one and all to come. We want your ideas, we want your personal acquaintance.

But of one thing, beware, the spirit of the West is magnetic, you may never go home again!!

Electric Power Anaconda Mining Company

No one has ever visited Butte, Montana, and left the metropolis of the great Treasure State with a blank or negative impression of the city. This greatest mining camp in the world is above all spectacular and unique. With its high buildings intermixed with a background of derricks and mine hoists, it presents to the visitor a weird but impressive sight, and finally suggests a possibility that there is before his vision a combination of modern city and ancient cliff dwellers' residences. But Butte is not in its appearance alone unique. Like the big State within which it is situated, the ideas put forth and believed in at Butte are big. Its mines yielding their millions naturally allow combinations and concentrations that could not be attempted elsewhere.

Situated about 130 miles to the northeast of Butte is a source of water power second to only one other in the United States. The Falls of the Missouri River at Great Falls, Montana, represent fabulous possibilities for future development of electric power. This power is now being developed on a gigantic scale which is largely controlled by interests affiliated with the Anaconda Mining Company and it is estimated that the power can be delivered in the city of Butte at a profit of $25 per h.p. per year.

Although the Anaconda Company has its own coal mines in Montana and Wyoming, thus furnishing its own fuel for steam, it is said that the cost for generating steam per h.p. per year is often in the neighborhood of $80 and where heat is used from the smelting of ores at Anaconda the cost has never gone below $60. The early possibilities of this great saving is a matter of much interest.

The operating of a mine hoist by compressed air which has been generated by an electric motor as primer mover is not new. It has been in existence in California and other States for years. The sudden call upon the receiver and the uneven operation incident thereto has necessitated in the past the installation of far heavier and more powerful motors than were necessary to meet average conditions.

In Butte the new electrical installations are unique in two particulars. First, the size and design of the electrical equipment and, second, the equalizing scheme used to save the power line furnishing the electricity for the compression of air from peaks, due to rapidly varying and intermitten loads imposed by the hoisting engines themselves. The adaptation of this method of applying power to a large number of hoists, all to be operated from a central power plant, is the first of its kind ever attempted. The total capacity of 25 of the largest steam-driven hoists in Butte amounts to 40,000 horsepower. The service required of these hoists is so intermittent, however, that the percentage of time they operate at full speed is so small that the average power required to operate all the hoists does not exceed 4000 h.p. Two months' operation of a portion of the installation has proved highly successful.

Upon the top of this innovation comes the announcement that the company's railroad, known as the Butte, Anaconda & Pacific Railway is to be electrified at an early date. The road has 50 miles of track, 27 of main line and the remainder of side tracks through the various mines at Butte and smelter at Anaconda. It is also prepared to introduce eventually an electric haulage system underground.

It is claimed that when the substitution of electric and air power for steam is completed in all the properties of the Anaconda company, it will mean a saving to stockholders of at least one per cent per pound in the production of copper, as compared with the present steam operating costs.

The signs of the times are slowly but inevitably tending toward the replacement of steam by electrical energy. The next great movement: namely, the electrification of the mountain passes and tunnels on the great transcontinental service, is each day brought one step nearer.

PERSONALS.

G. C. Noble, consulting engineer, has been at Bakersfield during the past several days on business.

W. H. P. Hill, a light and power official of Monterey, recently spent a few days at San Francisco.

Robert B. Moran, consulting engineer, has been a busy visitor in Southern California during the past two weeks.

E. F. Flinn, of the Allis-Chalmers Company's sales corps, with headquarters at San Francisco, is making an Eastern trip.

J. D. Farwell, who is connected with the lighting system at Los Gatos, was a San Francisco visitor during the past week.

Jos. N. Le Conte, hydraulic expert, is home again in Berkeley after a very pleasant month's outing in the high Sierras.

J. S. Thompson, manager of the Pacific Electric & Mfg. Co., has returned to San Francisco from a successful trip through Southern California.

H. C. Camp, electrical engineer, is a recent arrival at San Francisco. He is touring the Pacific Coast and inspecting high-tension power transmission systems.

Geo. Cole of the John R. Cole Co. is again at the San Francisco headquarters of the house. Benjamin Chase has recently been made Los Angeles representative.

H. W. Crozier, of Sanderson & Porter's Pacific Coast branch office, has been visiting Victoria, B. C., where the firm have supervision of two large engineering jobs.

H. F. Dodge, division commercial superintendent, and H. C. Chace, division traffic superintendent, returned to San Francisco at the same time after visiting Los Angeles.

Hugh McPhee, district commercial superintendent of the third district of the Western Union Telegraph Company, with headquarters at Los Angeles, arrived at San Francisco last Monday.

F. H. Varney, engineer of operation and maintenance in the steam section of the San Francisco Gas & Electric Company, has returned to San Francisco after a tour of Southern California.

C. A. Rhodes, who was recently appointed division auditor of the Western Union Telegraph Company's Pacific Division, comprising eleven states, has opened his office at Room 239, Russ Building, San Francisco.

K. E. Van Kuren, a special switchboard engineer of the Westinghouse Electric & Manufacturing Company of East Pittsburg, has just returned to the East after spending some time on a tour of the Pacific Coast.

H. G. Glass, one of the engineers of the Westinghouse Electric & Manufacturing Company, with headquarters at East Pittsburg, spent the past week at San Francisco visiting W. W. Briggs, the company's Pacific Coast general manager.

Loren Hunt, one of the engineers under City Engineer Marsden Manson, has been promoted to the position of chief assistant engineer in place of H. D. H. Connick, who resigned to take a position with the Panama-Pacific Exposition project.

J. C. Farrar, specialist in bus-bar and high-tension switching construction was in San Francisco from Los Angeles this week on his way to Portland and Seattle. He reports that construction at the new Long Beach plant of the Southern California Edison Co. is progressing rapidly.

F. V. T. Lee, a capitalist of London, who was at one time assistant to the general manager of the Pacific Gas & Electric Company, visited San Francisco during the past week on his way to Bohemian Grove where he will witness the "high jinks" of the Bohemian Club before returning to England.

C. L. Cory, the well known consulting engineer of Berkeley and San Francisco, has returned from an extensive trip through the northwest. Professor Cory has been absent for the past five weeks during a large portion of which time he has been engaged in valuation work for the Washington Water Power Co. at Spokane.

ELECTRICAL CONTRACTORS' ASSOCIATION NEWS.

E. C. Wakeland, a well known contractor of Oakland, has opened a place in San Francisco.

E. F. Burkhart, secretary of District No. 10, California State Association of Electrical Contractors, of Palo Alto, was at San Francisco last Tuesday on business.

Bids for a lighting system at Fort Miley were received August 3d from the following firms:

Newberry-Bendheim Co.	$16,500
John J. Sutton Co.	17,000
McFell Electric Co.	17,200
Standard Electric Co.	18,250
Butte Engineering & Electric Co.	20,477
Central Electric Co.	21,603
Decker Electric Co.	22,530

Secretary W. S. Hanbridge says:

It is with a great deal of pleasure that the reports from the National Convention of Electrical Contractors are received. If the coming year is as successful as the past there will be very few contractors who are not enrolled under the National banner. A number of very fine papers were read and it all means more light to the contractors, and we join with President Barnes in hoping that this convention will set a new mark with respect to establishing a closer community of interest between the several elements, which should work together in order that there might be a maximum of prosperity for all.

The next convention will be held in Denver, and from the looks of that baseball score (9 to 6), we will have to buy a few pitchers if we want to win the game in 1915. But don't get discouraged, fellows, as they only played three innings.

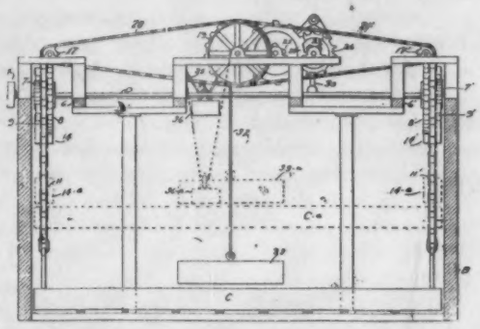
If they could only have seen Fleishman when the score was tied in the ninth at Catalina!

A great deal is being said about co-operation of the contractor and the central stations. A recent trial has been brought to our notice where the central station manager called the contractors together and told them he wanted to start a heating appliance campaign and he had instructions to put out solicitors and advertise in papers. He made them the proposition that he would carry the stock and allow them the commission, if they would carry out the campaign. His proposition was accepted. He ran an ad telling people that appliances could be had for a certain price at the stores. The result was every contractor in town was working for him, and it is needless to say that the campaign was a success. Every contractor in town has a good word to say for such broad-minded methods.

An examination will be conducted on August 23-24 and 25 by the U. S. Civil Service Commission for the appointment of an electrical engineer and draftsman, salary $1200 per annum.

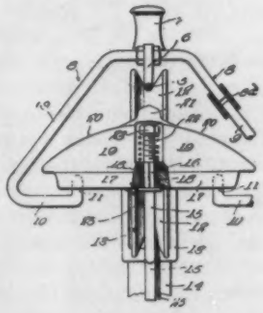
PATENTS

999,198. Tidal-Power Device. Thomas G. Bird, Eugene, Ore., assignor of two-fifths to Marcellus P. Bonnett, Eugene, Ore. A tidal-power device comprising a compartment, a float of suitable weight movable vertically therein suspended from sprocket wheels rotatably mounted on a main shaft, a rotatable main shaft having near its ends ratchet pinions rigidly secured



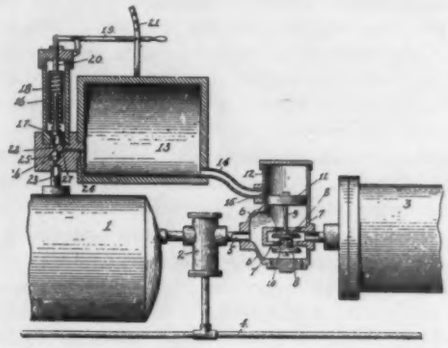
thereon and sprocket wheels rotatable on the shaft, provided with pawls on one face in position to engage the pinion ratchets when the float descends, link chains having one end secured to the float and passing over the sprocket wheels, also means to cause said chains to rotate the pawl sprockets reversely when the float ascends substantially as described.

999,312. Trolley-Switch for Station-Indicators and the Like. Orlando E. Kellum, Los Angeles, Cal., assignor to National Street and Station Indicator Company, Los Angeles, Cal., a corporation of California. In combination with a trolley wire and a member engaging therewith for longitudinal movement



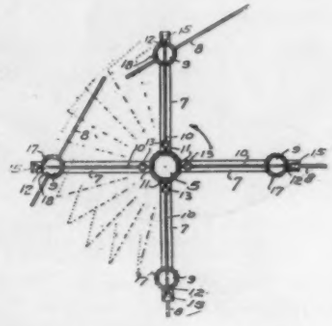
thereon, and a support for said member, a contact member suspended from the wire and having an upwardly facing contact surface thereon, and a contact member mounted on said support and adapted to pass over and engage with the contact surface on the first-mentioned contact member.

999,351. Air-Brake Apparatus. John H. Wallace, San Francisco, Cal. In air-brake apparatus and in combination with the auxiliary reservoir, brake-cylinder and triple-valve; a regulating reservoir of the same capacity as the brake-cylinder, connected primarily with the auxiliary reservoir and provided with means for arbitrarily defining the primary pressure received therefrom, said regulating reservoir being also secondarily connected with said auxiliary reservoir through the triple-valve; and means controlled by a difference of pressure in said secondary connection for keeping open the communication between the triple-valve and the brake-cylinder, until the pressure in the latter exceeds that primarily given to the



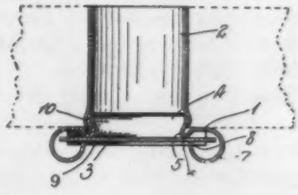
regulating reservoir, and thereupon closing said communication and admitting the excess of pressure into the regulating reservoir through said secondary connection.

999,423. Windmill. Earl Woodrum, Glencove, Wash. In a windmill, the combination of a fixed post; a set of arms rotatably mounted thereon; wings pivoted to said arms; a fixed gear mounted on said post; gears secured to said wings;



means connecting the fixed gear to the wing gears whereby said wing gears are operated by the rotation of the mill; means for releasing said connecting means; and means mounted on said wings and controlling said releasing means.

999,457. Flume-Gate. George E. Kellar, Los Angeles, Cal., assignor to Kellar-Thomason Manufacturing Company, Los Angeles, Cal., a corporation of California. A flume gate compris-



ing an apertured plate having a flange projecting to one side from the edges of the apertures in said plate and a tubular portion having its edge fitting upon said flange, and crimped tightly thereon for joining the parts.

INDUSTRIAL

ALTERNATING CURRENT TRANSMISSION LINE CALCULATOR.

While the determination of the voltage and energy loss in alternating current transmission lines and distributing circuits does not present any especial difficulty to the designer who has frequent use for the necessary tables and formulas, there are many operating engineers and superintendents who are responsible for results and recognize the value of accurate methods but whose knowledge of the technical details involved has been crowded out of mind by broader executive problems. It is in view primarily of the needs of the latter class that there has been devised and is now being placed on the market a simple and reliable device for calculating the line drop and energy loss in alternating current circuits. This device is called the "Alternating Current Transmission Line Calculator," and is made by Robert W. Adams, and is for sale at the Technical Book Shop, 604 Mission street, San Francisco, for one dollar each.

Fig. 1. Transmission-Line Calculator.

The calculator consists of two disks, a stationary one of opaque white celluloid 4⅛ in. in diameter and a revolving one of transparent celluloid 3 9-16 in. in diameter, eyeleted to the stationary disk so as to turn easily upon it. These disks are printed with the necessary diagrams, the stationary diagram being in red and the revolving diagram in black to permit of easy reading. The printing is done by a patented process which renders the lines moisture proof and nonerasible. The ranges of the various scales are as follows: Load, from 10 kw. to 20,000 kw.; voltage, from 1000 volts to 50,000 volts; power-factor, from 10 per cent to 100 per cent; distance, from 1 mile to 100 miles; conductor, from No. 8 to No. 4-0; line drop, from 0 per cent to 20 per cent; frequency, 25 cycles and 60 cycles.

In operation it is only necessary to make two settings to obtain the result. The value of "K," which is obtained in the first setting, is a transmission factor depending on the load, voltage and distance of transmission, and this factor is used directly in the second setting to determine the line drop, or "regulation," which is defined as the difference in voltage between the two ends of the line expressed in per cent of the receiver voltage. The method of securing the result includes in an accurate manner the effect of load power-factor, which has become increasingly important with the recent remarkable development of motor load, and, furthermore, is easily reversible, a feature which is not possessed by the algebraic methods and one which is of great value where it is desired to obtain the size of wire necessary to produce a given drop.

Complete directions are printed on the back of the calculator, together with a typical example, by following which a person having no technical training whatever may readily learn the method.

Upon the back of the stationary disk is also printed a convenient reference table giving the weights and costs of bare and triple-braid weatherproof copper wire per mile of two-wire, three-wire and four-wire circuit. This table is new and will prove useful for estimating the cost of proposed lines. Another useful feature is that the two lower revolving scales ordinarily representing distance and transmission factor can also be used as an emergency slide rule for solving problems in multiplication and division. The time required for a person acquainted with the calculator to make a complete determination of line drop is stated to be less than one minute.

The calculator is based on the use of annealed copper wire at 20 deg. C. (68 deg. Fahr.) or hard-drawn copper wire at 15 deg. C. (59 deg. Fahr.), and on three-wire, three-phase, and four-wire, two-phase circuits. Single-phase circuits can be calculated as easily as three-phase, although the device is primarily designed for three-phase circuits as being the most common for transmission work. The diagrams are based on a spacing of 18 in. between wires and are sufficiently correct for all practical work on circuits varying from 6 in. to 48 in. spacing. It is stated that the accuracy of the calculator will compare favorably with similar results obtained by any of the formula or graphic methods, and in all cases will come far within that of the original assumptions of load and power-factor.

IMPORTANT LIGHTING CONSIDERATIONS.

BY F. B. ALLEN.

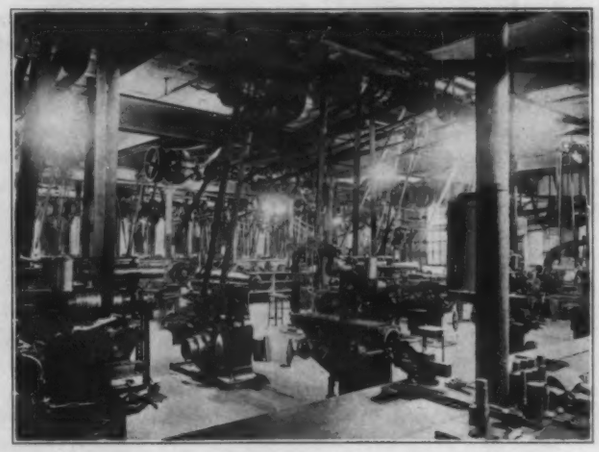
An employee's efficiency depends upon two things, ability and willingness to do the work. As far as ability is concerned, it is dependent upon three considerations: first, powers of perception, of which in nearly every case sight is of the greatest importance; secondly, brain, or intellect, to direct, and lastly, body to perform the work. Willingness to labor depends upon conscious and subconscious will. Consciously, wages are largely influential in producing the will to work; subconsciously, the realization of fair treatment by employers, and conditions in the factory tending toward health, such as correct illumination, temperature, ventilation and sanitation.

There are four qualities in illumination which should be considered: first, the correct amount of light, that is, the happy medium between dimness and dazzling brilliancy; second, the lack of glare of high intrinsic brilliancy; third, the lack of flickering, and lastly, the elimination of harmful radiations.

Under the correct amount of light we may say that the eye is able to work under a broad range of intensities. Thus, we can often read accurately in moonlight and still can do so in dazzling sunlight, the latter being over a million times the brilliancy of the former. It may be stated, however, that dependent upon the class of work, the eye should be exercised under from ½ foot candle to 15 foot candles. Glare is an extremely harmful characteristic in any illumination. It not only cuts down the ability of the eye to see accurately, but produces eyestrain and nervousness. Flickering is also an extremely deleterious quality. Its results are about the

same as are produced by glare: inefficiency of the eye in working, together with eyestrain, due to the rapidity with which the eye tries to re-focus under the different intensities. This quality may be brought about in either one of two ways. Either the light source varies in intensity or the light upon a given plane of working is not even. In either case the eye must re-focus very often.

The most effective rays in producing vision are the yellow and green. The fact that these are the principal rays in the spectrum of the Cooper Hewitt lamp accounts largely for the reason why many consider it to have very high illuminating efficiency. The rays on either side of these in the natural spectrum are of less practical value, since they require to be much more powerful in order to produce the sense of vision, and hence strain and fatigue the eye to a correspondingly greater extent. The red and heat rays are particularly irritating for this reason. The different colors also produce well known mental effects. Thus, red is exciting, while blue and violet are depressing. The use of a red flag in bull fights and the well known expression "feeling blue" are recognitions of this fact. Yellow gives contentment, while green is restful.



Shop Lighted by Cooper-Hewitt Mercury Arc Lamps.

Many consider that the mercury vapor lamp has qualifications which are extremely advantageous to industrial illumination. It is a scientific fact that the eye will focus more accurately under the green rays produced by this lamp than under a combination of the seven colors of the spectrum. For this reason it is extremely advantageous to employ the light where accurate eye work is required. It is evident for the same reason that the eye can see more distinctly under lower intensity of illumination with green light than with a combination of the seven colors of the spectrum. The application of this to industrial illumination results in the ability to entirely eliminate auxiliary lights of small candle power where ordinarily the illumination from an overhead system would not be sufficient.

The light produced by the mercury vapor lamp is extremely low in intrinsic brilliancy, the amount of light being produced rather from the area than from the brilliancy of the source. This results in a total absence of glare, not only where the source is directly exposed to the eye, but from polished surfaces. This reflection of glare from polished surfaces is found to be extremely annoying and of as serious a character as the exposing of the direct rays of the lamp.

Where Cooper Hewitt lamps are employed, the system is of an overhead character. The lamps are placed to light a certain number of square feet and are laid out symmetrically, regardless of the placing of the work beneath. This produces a perfectly evenly distributed light on the floor. It may be seen, therefore, that upon a working surface no different intensities of illumination will be found, and, therefore, the eye will not be called upon to re-focus. The source, which is the tube varying in length with the different types of lamps, is a steady line of light, being in any given period of exactly the same intensity. The length of the source is a very decided advantage, tending towards distribution and the elimination of distinct shadows.

An analysis of the qualities of the mercury vapor lamp will show that where color values are of little importance, the other qualities of the light are exactly those which are required to produce correct illumination for employees in industrial work. The importance of this cannot and must not be overlooked. For instance, in one of the large silk mills of the east, it is figured by a well known cost expert that the expense of producing their product at night is 20 per cent higher than that of producing it in the daytime. This may have been due to several things, but must be largely attributed to inferior illumination. Had those people in their factory had an illumination during the dark hours which was as good for working purposes as the best daylight, their cost of production during that time would very evidently have been largely decreased. It seems strange that the importance of this consideration has been overlooked, particularly in view of the fact of the extremely low comparative cost of units of illumination and of their operation.

A large modern factory, it may be figured, can produce power at a cost of one per cent per kilowatt hour. A mercury vapor lamp can be run five hours at a power expenditure of one kilowatt hour. On an average in industrial lighting one mercury vapor lamp will take care of at least two men. Figure an average cost of 40 cents per hour to employ these two men. This would mean an expense of $2.00 to employ these two men five hours, whereas perfect light for them can be produced for one cent. In other words, if perfect light will save one-half of one per cent of a man's time, it has paid for its total cost of operation.

Not only that, but the value of machinery and factory investment is increased in proportion as the efficiency of the men is increased. Thus, with improved illumination it is not difficult to imagine that 20 machines will do the work that 25 had done heretofore. The value of the given investment has increased 20 per cent, or probably ten times the value of the lighting units to produce this result.

These are the important considerations in any lighting installation, and cannot be overlooked. Any system of figuring which does not consider these points is entirely fallacious and can mean but little.

As far as actual operating cost goes, however, it may be said that many consider the mercury arc lamp to be one of the most efficient units at present on the illumination market. Further, its cost of up-keep is extremely low, both as to attention and repair parts required to operate, and as to the actual renewal expense of the tubes. It may be conservatively said that ½c per kilowatt hour will cover all maintenance and expense of operation.

TRADE NOTES.

The Great Northern Railway, which already has nearly 4,000 miles of track equipped with telephone train dispatching equipment, has just placed an order with the Western Electric Company for thirty-two telephone selectors to equip its Cascade Division.

The Arctic Mining and Power Company have closed contracts for an electric generating plant to supply power for use at their mine in Nevada County, Cal., and also for transmission about ten miles to surrounding mines. The Fort Wayne Electric Works will furnish a complete 5-panel switchboard for the distribution of the current from a 600-kw., 6000-volt generator ordered from the Ridgway Dynamo and Engine Company of Ridgway, Pa.

NEWS NOTES

FINANCIAL.

AUBURN, WASH.—The Council is to call a special election soon for the purpose of bonding the town for $15,000 for municipal purposes.

ELLENSBURG, WASH.—Voters of this city are to be asked to approve a bond issue of $100,000 to improve the municipal light plant.

SACRAMENTO, CAL.—That $100,000 will be spent in the next year in extending the East Sacramento Water System is the statement made by H. McClelland, president of the East Sacramento Water Co.

EUGENE, ORE.—Bids will be received by city recorder, R. S. Bryson, up to Aug. 24th for the purchase of $57,000 light, power and water bonds.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, will call for bids at once for the painting of about 20,000 light poles throughout the city.

PENTICTON, B. C.—Bids were received up to August 16th for furnishing of electrical equipment, power station, pressure pipe and plant complete.

SEATTLE, WASH.—The Seattle-Tacoma Power Co., 7th and Jefferson Streets, will erect a $1,000, 1 story, fireproof, steel and reinforced sub-station, 1763 Railroad Avenue, near East Waterway. Owners, architects and builders.

MONMOUTH, ORE.—The City Council has taken up a bill preparatory to the issuance of bonds for the construction of a water system. The bill provides for the issuance of $25,000, but for the sale of only such part as may be necessary to complete the system.

PORTLAND, ORE.—The Mt. Hood Ry., L. & P. Co., Lewis bldg., have taken out a permit for the construction of a 2 story reinforced concrete sub-station, to be erected at the foot of Williams Avenue. The building to cost $60,000. The owners are the builders.

SPOKANE, WASH.—The Spokane Falls Gas Co. is to expend $18,000 on the extension of its mains to the north hill district. Contracts amounting to $15,000 have been let to the Improvement Equipment Company of New York for reconstruction of the coal gas generator capacity.

EXETER, CAL.—Not desiring to place any larger debt than is necessary on the city of their adoption the trustees in regular session, decided to cut down the proposed bond issue to the tune of $3,000 or to call for $42,000 instead of $45,000. A resolution was adopted determining that the public interest and necessity demand the construction of a water system in said city, and the estimated cost is $42,000.

WHITE BLUFFS, WASH.—It is probable that formal announcement will be made within two months by the Pacific Power & Light Co., of its intention of the expenditure of between $6,000,000 and $10,000,000 in the development of hydro-electric power on the Columbia river, at Priest Rapids, near this city. The improvements include the construction of a dam at the rapids, 75 ft. in height, construction of the high line ditch of the Hanford project, and the construction of a network of electric power transmission lines in this vicinity and providing power to a large section of Eastern Washington.

LOS ANGELES, CAL.—John B. Miller, president of the Southern California Edison Company, says that the industrial growth of Southern California has increased to such an extent that more electricity is now used for power than for lighting purposes. A close scrutiny of the increase in the use of power shows that it is general over the entire system. The manufacture of cement has been the largest single industry for which electric power has been used until recently, now its adaptation to pumping oil wells and for refining purposes is taking first place. And the agricultural phase of power consumption is almost as important as the manufacturing feature.

SAN FRANCISCO, CAL.—The Metropolitan Light & Power Co. has filed an agreement in the U. S. Circuit Court similar to that of the San Francisco Gas and Electric Co. in regard to rebates. Under the terms of the agreement the consumers will be paid back the sum of $38,791 for the year beginning July 1, 1909, and $49,193 for the year ending June 30, 1911. The interest, amounting to $1606, will be divided between the corporation and the city and county of San Francisco after the expenses of Court Commissioner Maling have been paid. Under the same agreement the gas rates for the next six months ending Jan. 1, 1912, will be 85c per thousand, and after that date until June 30, 1912, the rate will be 80c per thousand.

SAN FRANCISCO, CAL.—A statement of the receipts of the United Railroads for the year 1910, on which a percentage to the city must be paid, has been filed by the company with the Supervisors. It puts the amount of the city's percentage at $38,756.98. The amount paid for 1909 was $37,482. The figures for the various United Railroads lines are set down in the statement. Most of the lines pay 2 per cent of the gross receipts to the city, seven of them 3 per cent, and one, that running on 6th and Sansome streets, 4 per cent. The receipts on the lines subject to the 2-per-cent tax were $1,784,837.54, on the 3-per-cent lines $83,296.91, and on the 4-per-cent line $14,033.49. The filing of the statement was delayed, as the company wanted to ascertain whether or not the new State tax law relieved it from liability for further payment of its franchise percentages. It found that it still had to pay.

MODESTO, CAL.—The sale of the lines, equipment, franchise and good will of the La Grange Water and Power Co. in Modesto to the Sierra and San Francisco Power Co. is announced officially here. The price paid was $50,000. This transaction ends the competition between two lighting companies of the city, since the La Grange Co. came into the field over five years ago. It is understood that no other branch of the Mount Whitney Power Co, the holding company for the La Grange, has been effected. The Sierra and San Francisco Power Co., of which George W. Bacon of New York is president and in which Patrick Calhoun is heavily interested, retails power in no part of the country except in this section of the San Joaquin Valley. The big plants of the company near here send 80,000 h.-p. into Modesto, and the United Railroads in San Francisco are operated by the company. It is understood that John Hays Hammond represents the majority of the capital behind the corporation, which has just sold the La Grange Power Co.

INCORPORATIONS.

PORTLAND, ORE.—Pierce-Tomlinson Electric Co., capital $1,000, has been incorporated by T. F. Pierce.

SAN BERNARDINO, CAL.—The Pacific Electric Heating Co. of Ontario has been incorporated with a capital stock of $25,000. The incorporators are: E. H. Richardson, B. C. Shepard, C. A. Shepard and T. E. Parke, all of Ontario, Cal.

ALBUQUERQUE, N. M.—The Tucumcari Light and Power Co. has been incorporated with a capital stock of $100,000.

CHELAN, WASH.—The East Side Telephone Co. of Chelan has been incorporated for $2,500 by H. A. Steele and Chas. Colver.

CEDARHOME, CAL.—The Cedarhome Telephone Co. of Cedarhome has been incorporated for $10,000 by Peter Hanson and N. Nielson.

UNDERWOOD, CAL.—The Underwood Telephone Co. of Underwood has been incorporated for $2,000 by J. H. Hussey, M. Smith and H. Love.

SEATTLE, WASH.—The Williams Submarine Telegraph Co. of Seattle has been incorporated for $1,000,000 by A. Williams, Horace P. Chapman and G. Parsons.

ILLUMINATION.

ASHLAND, ORE.—The franchise of the Ashland Electric Light & Power Co. has been revoked. The city's municipal plant will soon be in operation.

GRANDVIEW, WASH.—This place has granted a 50-year franchise to the Pacific Power & Light Co. to furnish electricity. Service to be furnished in 60 days.

SIERRA MADRE, CAL.—The Southern Counties Gas Co. will supply Arcadia, South Santa Anita and Elmonte with gas from the Monrovia plant as soon as the main line now being extended is completed.

MARYSVILLE, CAL.—The Northern Electric intends expending a considerable amount of money in Marysville within the next three or four months for the erection of new car barns and a passenger station on C St., also building new yards and tracks.

SAN BERNARDINO, CAL.—The Board of Supervisors has passed an ordinance granting to the Southern California Gas Co. a franchise for a period of fifty years, to maintain a system of gas pipes under and along public roads and highways of San Bernardino County for furnishing gas for heat, light and power.

WATTS, CAL.—The Pacific Light and Power Co., through its representatives, Messrs. Burns and Davis, presented a proposition to the board for electricity and furnishing the city forty-five lights at a flat rate of $150 a month. $9,000 being the cost of construction. A contract for five years was entered into.

HONOLULU, T. H.—The progressive towns of Wailuku and Kahului are to have electric light and power, for the distribution and supply of which a franchise was granted to the Hon. H. P. Baldwin, B. A. Wadsworth, J. N. S. Williams, D. C. Lindsay, C. D. Lufkin, James L. Coke and W. T. Robinson. As the result of this decision the franchise has finally been purchased by the Island Investment Co. of this city, which will erect the necessary plant midway between Kahului and Wailuku and later turn both plant and franchise over to the Maui Electric Co.

SAN BERNARDINO, CAL.—For the purpose of establishing a $75,000 central plant for furnishing gas to San Bernardino, Redlands, Riverside and Colton, the Southern California Gas Co., a subsidiary corporation of the Pacific Light and Power Co., has purchased seven acres of land near Colton. The plant is to be constructed at once, plans now being drawn up. The lighting company recently was granted a franchise covering the roads of the county, by the Board of Supervisors. Five thousand dollars was paid for the building site, which is located on Colton Avenue, just south of Colton.

SAN JOSE, CAL.—J. H. Hornung, representative of the Great Western Power Co. announces that his company will put men in the field here to offer contracts for light and power in competition with the United Gas and Electric Co., which now has a monopoly in the local field. Hornung states that prices less than those which obtain will be offered, and that a service not subject to breaks on account of accidents on ditches and flumes is guaranteed. Hornung, in telling of the concern's backers says: "The company has a capital of $25,000,000, and is one of the most powerful concerns of the kind on the Coast. It recently absorbed the City Electric Co. of San Francisco. Edward Hawley, the famous railway man, is president, while the interests on the Pacific Coast are looked after entirely by Mortimer Fleishhacker. We are arranging now to put a cable under the bay and furnish electric power, generated by hydraulic power, into San Francisco and San Jose is naturally the next point to be reached. We shall do a gas and electric business, and our solicitors will sign up contracts for furnishing light and power."

TRANSMISSION.

LEWISTON, IDAHO.—The Nez Perce Power & Light Co. is making preparations to invade this territory, according to reports.

MOSIER, ORE.—The Pacific Power & Light Co. has about started construction work on an electric supply line from The Dalles to this place.

CONCORD, CAL.—The Board of Trustees passed an ordinance granting to Great Western Power Co. a fifty-year franchise for a transmission line through this city.

ROSEVILLE, CAL.—The Northern Electric Co. proposes to extend its electric system to this city for the benefit of the fruit interests between Roseville, Orangeville and Fair Oaks.

PT. ANGELES, WASH.—P. J. Woods of this city was awarded the $18,000 contract by the Olympic Power Co. for preparing the right of way for the transmission line for the entire way from this city to Irondale.

RIVERSIDE, CAL.—The Board of Supervisors has passed an ordinance granting to Fred B. Mechling, franchise for a period of fifty years for a transmission line along all public roads and highways in Riverside County.

SALINAS, CAL.—The Monterey County Gas & Electric Co. has made application to the board of supervisors for a franchise for a period of thirty years for a transmission line along all public roads of Monterey county.

KLAMATH FALLS, ORE.—It is announced that the Siskiyou Light & Power Co. is having surveys made for the extension of the power line to Klamath Falls. The 80 h. p. turbine has been installed and will be ready for operation in about 3 weeks.

SAN BERNARDINO, CAL.—The Board of Supervisors has awarded the franchise for an electric pole line throughout the county to the California, Nevada Power Co., composed of Denver capitalists, at $150,000. Work will start at once and $10,000 will be expended within three years.

TRANSPORTATION.

PORTLAND, ORE.—Immense car barns are to be erected by the Portland Railway, Light & Power Co. between East 26th and East 28th and East Burnside and East Couch streets in this city.

BERKELEY, CAL.—The Council has passed an ordinance granting permission to the Oakland Traction Co. a franchise for a single or double track street railroad, to be operated by electricity upon certain streets in the city of Berkeley.

SANTA MONICA, CAL.—The city council has passed an ordinance granting to the Los Angeles Pacific Company the right to construct and for a period of forty years to operate a single or double track electric railroad along certain streets of the city.

CORVALLIS, ORE.—The entire holdings of the Corvallis & Alsea River Ry. Co. has been sold to the Portland, Eugene & Eastern Ry. Co., including 31 miles of right of way track terminals at this place, rolling stock, etc. The purchasing company, it is reported, will electrify 18 miles of the road from this place to Monroe and then extend the line from Monroe to Eugene, a distance of 22 miles. Power for operation of the new line will be furnished by the Oregon Power Co.

OAKLAND, CAL.—That the electrification of all the old S. P. lines throughout Oakland, Alameda and Berkeley will be completed by the first of December, is the report of the engineers in charge of the work. This includes the three lines in Alameda, the second of which will be in working order within the next two weeks, the loop over Franklin and 20th Streets and the 7th Street and East Berkeley lines. Plans are being drawn for the enlargement of the old train sheds at the mole in an effort to do away with the long waits and confusion caused by the single-track system on the suburban lines. It is proposed to have two tracks for the horseshoe, East Berkeley and 7th Street trains.

OAKLAND, CAL.—An official of the Oakland-Antioch Railway announces that it had been practically decided to construct the Danville branch, but that the Martinez project was still under consideration. The present terminal of the line is at Bay Point, a point seven miles from Martinez. Two routes are being considered for the branch to this place. The first is along the shore of San Francisco Bay, direct from Bay Point. This route would take in a half-dozen important manufactories and industries situated along the bay shore. The other route being considered is to branch off at Concord, come through the Alhambra Valley, touch at Pacheco and on into Martinez. The branch to Danville is to leave the main line of the electric road at Walnut Creek.

WATERWORKS.

PUYALLUP, WASH.—At a special meeting of the city council it was decided to construct a pumping station and lay water mains at Maplewood Springs.

ASTORIA, ORE.—Construction is under way on the contracts amounting to $100,000 to include the building of new reservoir and laying of high service mains.

CENTRALIA, WASH.—The Council has granted to the Washington-Oregon Corporation the authority to maintain water mains across public streets in this city.

NOGALES, ARIZ.—The Nogales town council has decided to call a bond election to determine whether or not Nogales should issue bonds to supply funds for municipal water and sewer system.

PENDLETON, ORE.—The city water commission has purchased of Nancy E. Despain several blocks above the present reservoir to be used for the site of the reservoir for the new gravity system.

DORRIS, CAL.—Sealed bids will be received by the clerk of the Board of Trustees up to August 25th, 1911, to build the Dorris Water Works system, according to plans and specifications on file with the clerk.

CHALLIS, IDAHO.—The electors voted bonds for the construction of a system of municipal water works. The proposition was carried by a vote of six to one. Within the next few months the city will have a water system.

KLAMATH FALLS, ORE.—Announcement has been made by officials of the Klamath Falls Light and Water Company, that Shippington, that portion of Klamath Falls bordering on the Upper Klamath Lake, is soon to be supplied with city water.

ASTORIA, ORE.—The Board of Water Commissioners have decided to put in a dam at the head works for the purpose of increasing the storage capacity of the water system and the engineer has been ordered to prepare and submit plans accordingly.

TROY, IDAHO.—The Board of Trustees has offered for sale the $12,000 negotiable coupon bonds, to bear interest at 6 per cent per annum to be paid on first days of January and July in each year at the Chase National Bank, New York, N. Y., to be due in 20 years.

MARSHFIELD, ORE.—The council of this city and that of North Bend, have united with a view of securing data in regard to the construction of a municipal water system to serve both cities. The cost of construction will be obtained and a competent engineer will make surveys and investigate other water supplies.

CHELAN, WASH.—Engineers employed by O. A. Hoag have started preliminary surveys for the construction of a pipe line to take water from the Chelan river for power purposes. The water will be taken from the river near the city dam and carried to a point near Lake Chelan where the water will be utilized in a water plant.

SANTA ROSA, CAL.—The Santa Rosa Water Works has commenced work at the spring, formerly owned by the Fountain Water Co. The plans of the company have not been fully matured but it is their present intention to proceed with the work of installing a rotary pump with direct connection with an electric motor which will be used to pump water from the spring to an elevated point between it and the present reservoir of the company.

OAKLAND, CAL.—The Board of Supervisors has called for bids for the construction of a water plant on the Altamont road, the system to cost in the neighborhood of $8,300. Bids were called for a retaining wall in the San Lorenzo creek at an estimated cost of $1400 and a bridge and retaining wall near Brightside to cost $3600. The contract for the construction of a water plant on the Lake Chabot road was let to Thomas B. Russell on his bid of $2944.

TELEPHONE AND TELEGRAPH.

JOSEPH, ORE.—J. F. McClain, superintendent of the Wallowa forest reserve, has received instructions to build a line from Joseph to the Rangers camp, a distance of 15 miles.

VANCOUVER, B. C.—The British Columbia Telephone Co. has presented plans for the construction of its propcsed pole line on the north side of 11th avenue from Glen to Woodland avenues, and for underground work on the south side of Pender street.

HOLLISTER, IDAHO.—The local telephone system and exchange connecting with the Bell line to Twin Falls and other points on that system and communicating with Jarbidge over the line of the Idaho, Nevada Telephone Company will be established as soon as sufficient subscriptions have been obtained.

SAN FRANCISCO, CAL.—The architectural department of the Pacific Tel. & Tel. Co., with offices in the New Montgomery exchange building, have completed the plans for the construction of a three story and basement brick building, which will be used for the company's business in the Sunset District. The building will be located on H street near 19th avenue and when completed will cost in the neighborhood of $30,000.